THE

ELECTRICAL REVIEW.

VOL. LV. JULY 22, 1904. No. 1,391.

ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

1904 Edition

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THE FINANCIAL POSITION OF MUNICIPAL ELECTRICAL UNDERTAKINGS.

WHILE the paper read by Councillor Blakeway before the Incorporated Municipal Electrical Association (see p. 155) cannot be said to have shed much light on the dark corners of municipal finance, it may nevertheless be indirectly productive of good results. We trust that many municipal enthusiasts will ponder over the questions which the author propounds, and that they may go further towards finding the correct answers than he has done. To put the matter briefly, Mr. Blakeway asks of his brother councillors and ratepayers:—"Where are we? and whither are we going?"

From time to time we have urged in no half-hearted fashion that municipal finance is based upon a false foundation—viz., the assumption that a sinking fund is equivalent to a depreciation fund. To argue that companies are in no better a position is to beg the question; company shareholders must look after their own interests, and if they neglect them, that is their own affair. But in municipal trading it is the ratepayers who have to make up any deficit that may accrue, and it is part of our duty to uphold their interests when we see them endangered. In his paper the author points out that 63 out of 155 municipal undertakings show a deficit, and, on the average, less than 1 per cent. on the capital invested is available for the formation of a "depreciation or renewals fund." The author goes on to say: "How many of us have such a fund, and is the necessity of having one generally realised?" Very few have one worth mentioning, and the necessity of having one, which he clearly perceives, is by common consent ignored. The penalty for this neglect will fall, not upon the Councillors who have initiated it, but upon their successors; but the ratepayers will pay the rates, no matter who is to blame. It cannot be too strongly emphasised that, as Mr. Blakeway says, not a penny should be allocated in aid of the rates from the surplus, when there is one, until the renewals fund stands at a substantial figure. Fresh capital cannot be raised to provide for renewals until the original loans are wiped out—except by deliberate evasion of the regulations of the Local Government Board, and the deception of their officials; and can that finance be called sound which depends upon subterfuge? Is the plant of an electrical undertaking like the famous One-hoss Shay, which never needed repair until, at the end of its life, it all fell to pieces at once? It is too much to hope that electrical plant will last in efficient condition for 30 years. Unfortunately, the author's courage failed him; for when he had put the questions quoted above, he said that the object of his paper was not to deal with a depreciation fund, and "this may be passed over"—the old policy of *laissez faire*.

With the rest of his paper we are by no means in agreement; Mr. Blakeway says that the main object of the

undertakings is to supply current for lighting purposes, and this at as low a rate as possible. We have an idea that very many such undertakings are carried on for the glorification of the undertakers, but "this may be passed over." The author, however, quarrels with the low prices charged for power and traction supply, and appears to be quite unable to realise that these are on a totally different footing from lighting service. The main object of an electricity supply undertaking is to supply electrical energy for all possible purposes; if the undertakers fail in carrying out this object, the sooner they retire from the business the better for all parties. So far from the lighting consumers forming a large proportion of the community, they are but a very small percentage of the ratepayers. The latter take the responsibility and the risks, and the business must be carried on upon business lines for their benefit, not for the benefit of the lighting consumers only or even primarily. Electric tramways are far more beneficial to the general body of ratepayers than private electric lighting, and on this basis the tramways should have the preference, if preference is to be allotted. As for the power load, it seems clear that Mr. Blakeway does not use electricity for this purpose; presumably he is a lighting consumer, judging by the exaggerated claims which he puts forward on behalf of this class. But who pays the heaviest rates; the private lighting consumer or the manufacturer? The latter gives employment to thousands of the ratepayers, whose interests coincide with his. Cheap power is a necessity of modern times, and carries with it innumerable benefits affecting the health and comfort of the working classes. The lighting consumer is usually well-to-do, and is less in need of solicitous consideration than the tramway passenger or the factory hand—yet he is coddled as though he were the be-all and end-all of electricity supply. We protest against these false ideas of the functions of such an undertaking, nowhere more out of place than when entertained by the very representatives of the people. And we urge close consideration of the pregnant paragraph with which Mr. Blakeway ends his paper:—

"Unless we are all careful and prudent, we shall find our capital expenditure grow beyond a remunerative point; we shall also in the more or less near future, have to face within the periods of our borrowing powers, heavy renewals; and the points raised in this paper are crystallized in the question, *will our present and prospective revenues on their present basis meet the demand?*"

The Maintenance of Tramway Track.

THE case of the Mayor, &c., of Norwich *v.* the Norwich Electric Tramway Co., a report of which appears in another column of the present issue, illustrates with some force the nature of the responsibilities which are imposed upon an electric tramway company in the matter of road repairs. The action was brought by the Corporation of Norwich to recover certain expenses incurred by them in the repair of a road along which the defendant company had laid a line. It appeared that the road round the metals was paved with stones, while the space between the track and the kerb at either side was filled with macadam. Owing to the macadam falling into disrepair, there was a drop between the stone pavement and the macadam, which rendered the road dangerous to passing traffic. The Corporation having levelled up the macadam so as to make a clean junction between the macadam and the pavement, brought this action to recover damages from the company. It is provided by Sec. 57, Sub-sec. (5), of the Norwich Electric Tramways Act, 1895, as follows:—"If the company fail to maintain and keep in good condition to the satisfaction of the Corporation . . . . (5) the junction of the paving laid and maintained by the company with the surface laid and maintained by the Corporation, the Corporation may, if they think fit, themselves, at any time after seven days' notice to the company, do the work necessary for the repair and maintenance of the road, and the expense reasonably incurred by the Corporation in so doing shall be repaid to them by the company, with the addition of 5 per cent. of such expense." Having regard to the somewhat stringent provisions of this section, it is not surprising that the learned judge who tried this case (Mr. Justice Phillimore) gave judgement for the plaintiffs, making a declaration in the following form:—

"That the obligation of the company, under Sec. 57 (5) of the Norwich Electric Tramways Act, 1897, to maintain and keep in good condition the junction therein mentioned extends to cases where, by reason of the presence of tramways in a road, the traffic in such road has caused the surface laid down and maintained by the Corporation to become worn down below the level of the paving laid and maintained by the company, and involves the maintenance by the company of a uniform and unbroken contour of such surface and paving, whether that is to be effected by the raising of the surface immediately adjoining such paving or the lowering of the paving itself."

We do not know of any case in which the liability of a tramway company has been made so extensive. It practically amounts to a declaration that they must keep the entire road in repair. "Repair," moreover, involves something more than liability to renew the macadam or the paving setts when they fall into decay. If the surface of the road becomes slippery, so as to be a source of danger to horses, the tramway company must lay sand or take other precautions to prevent horses falling. In short, the law as it now stands relieves the ratepayers of an immense burden; a burden which is borne by the shareholders in the tramway company. This is a fact which should not be lost sight of by those who cavil at the monopoly of tramway service being given to a private company.

Coal-Dust Firing.—We referred recently to a paper read in America on coal-dust firing, the author of which stated that it was so very difficult to secure any degree of cleanliness about a plant for grinding and burning coal dust. The Cyclone Pulverising Co., of Cable Street, E., quarrel with this opinion, and as we have always believed in the principle of firing coal as dust, we went to see an example of a Lancashire boiler fired with dust ground on the spot. There was practically no dust visible. Small dirty coal is run from a bin through a shaking feed, like the old jigger of the corn mill, and passes on into a disintegrator, in which it is beaten about by revolving beaters until fine enough to be floated off by the exhaust fan, which draws air through the pulveriser. This air can only carry off the dust when sufficiently fine. The problem is to get rid of the air. The fan simply discharges its burden into a room, the walls of which are made of a kind of flannelette. The walls afford a large area of escape for the air, but the dust is all kept back, and, falling to the bottom of the chamber, is taken to the hopper of the boiler, whence it is fed by a revolving worm into the eye of a fan, and sprayed into the furnace in a constant and regular cloud. It burns like gas, and the clinker is drawn out in liquid form from ash pit doors. The furnace bottom is lined for 12 ft. of its length in fire-brick, and the furnace crown for about half the distance, and there is a baffle bridge further on. This enables perfect combustion to be secured, and this furnace lining is what ought to be practised for ordinary firing also, and is what we have long advocated as necessary. The furnace draught was induced by a fan. What we should like to see is an installation of coal-dust firing, carried out with the intention, from the start, of removing flue dust by gravity shoots and provision to catch all that tries to escape at the chimney, by a properly arranged chamber. We can certainly endorse the Cyclone Co.'s claim that they carry out their whole system in a perfectly cleanly way, and we have no doubt they will secure good results in evaporation. We hope, at some future time, to illustrate the system, and to give further particulars.

THE COLLIERY EXHIBITION.

(*Continued from page* 84.)

The Reavell Air Compressor.—This compressor has already been described in our columns, so that a detailed description is, perhaps, not again necessary. Its chief features, however, may be referred to. The leading idea of the inventor was to provide an air compressor which might be easily driven from an electric motor. In the ordinary forms of compressor, unless very heavily fly-wheeled, the torque

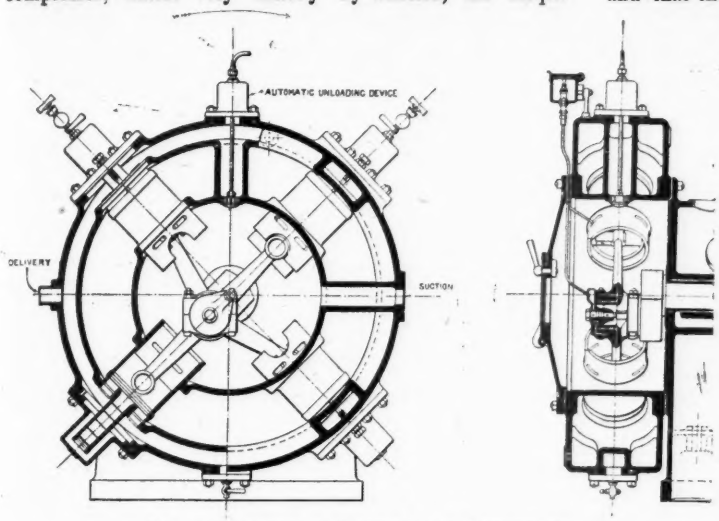


Fig. 12.—Section of Reavell Air Compressor.

curve on the motor is very irregular. This applies more particularly to single-acting compressors. In order to equalise the load, heavy fly-wheels are necessary, which, whilst not always offering any very great disadvantage in the case of stationary machines, is a matter of considerable moment in portable machines such as are now coming to the front for colliery work. The Reavell compressor is a single-acting constant-thrust machine, and is provided with four cylinders arranged radially to a common crank-shaft; each cylinder forms, as it were, a separate single-acting compressor, delivering air into a common delivery passage, and thus secures a practically continuous delivery of air. By this means the torque curve on the motor or engine driving the compressor is very uniform, even without any fly-wheel whatever. Being single-acting, the compressor may run at high speeds; but when we touch high speeds, the question of the valve gear becomes of paramount importance. So far as the air inlet is concerned, the valve difficulty is entirely overcome by the simple expedient of not having any suction valves at all. The air is admitted above each piston by means of a port in the latter. During the suction stroke this port coincides with a similar port in the top of the connecting rod. Near the end of this stroke the piston over-runs the ports cut through the cylinder wall, as shown in the illustration (fig. 12), thus making a direct communication between the cylinder and the inside of the compressor casing, this space forming a suction chamber. As regards the delivery valves, these are of the poppet type, made of steel, and are very light. A number of valves are used to each cylinder, so as to reduce the weight and lift to a minimum. These valves open during the compressing stroke when the air has reached the required delivery pressure; the air is then delivered into the annular passage shown round the compressor casing, and thence into the delivery pipe. An automatic unloading device forming a bye-pass valve connecting the delivery and suction sides can be provided with this compressor. This is controlled automatically by an air relay, which opens the bye-pass when the air pressure has reached the required limit. This is shown at the top of the sectional drawing.

The illustrations of piston and connecting rod (fig. 13) show clearly the suction ports. The hole in the side of the piston is designed to permit of the withdrawal sideways of the connecting rod.

A double machine was shown at the Exhibition, driven by means of a Dick, Kerr motor placed between the two machines. In this arrangement there are only two bearings for the motor and compressor together; the motor itself has no bearings, its shaft being coupled direct to the compressor shafts on each side. This makes a very compact arrangement, and as there are eight compression strokes during each revolution, the curve of torque effort is practically uniform. It is claimed by the makers that this compressor requires less power for driving than any other type, and that there is a gain of at least 5 per cent. in the volumetric efficiency of the compressor due to the absence of suction valves. It is also claimed that it is the only machine in which driving gears can be entirely dispensed with. This, however, is not the case, as we have seen other designs in which the motor is coupled direct to the compressor.

In their circular devoted to colliery work, the makers advocate the use of portable compressors for driving compressed-air machinery in mines, and refer to this as their system. So far as we know, there is no monopoly in the use of such a system as this, and, as mentioned in the earlier portions of our articles, the system is in use with other makes of compressors.

One sentence of this pamphlet referring to the saving by the above method, reads as follows: "In other words, our system enables *a saving of* 100 *per cent.* in power to be obtained over the average of present methods." Now, as the average is better than the worst conditions, it is obvious that the makers claim to save over 100 per cent. in cases below the average. "In other words," a Reavell compressor will drive itself and provide power for running other machinery. If a statement of this kind appeared in any less well-known maker's pamphlet, we should have regarded it as quackery, and consigned the pamphlet to the waste paper basket. We can only suppose that the pamphlet has been got up hurriedly for the Exhibition by some junior assistant, and that this passage has escaped the eye of the principal.

Messrs. John Davis & Co. exhibited a "Boreas" type of compressor made by the Lacy-Hulbert Co. This is geared to an electric motor, and is of the entirely enclosed type, specially designed for working underground.

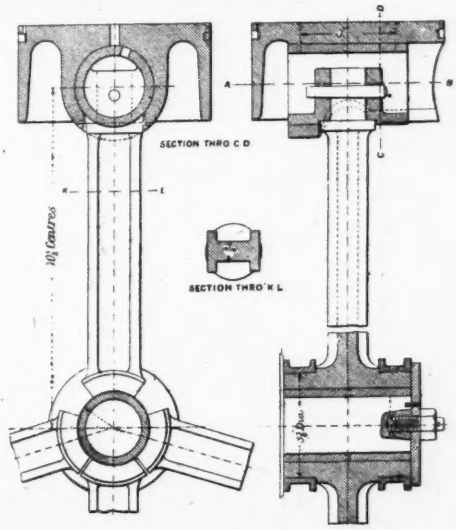


Fig. 13.—Reavell Compressor. Connecting Rod and Piston.

The Champion Rock Borer and Air Compressor Co. showed a vertical type of air compressor having two air cylinders and two steam cylinders mounted in tandem, the machine being fitted with heavy fly-wheels.

Messrs. Fraser & Chalmers are applying with considerable success the "Gutermuth" patent valve to compressors and blowing engines. This is used for both suction

and delivery valves, and permits of much higher speeds than is possible with the poppet type. This valve will be fully described next week under "Pumps."

(*To be continued.*)

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

Bowker's "Management of Tramways."

It is quite evident that you do not follow out your own wise suggestions as regards "sarcasm." Now, it is only a few weeks since, in one of your leading articles, you stated that when one argues through the intermediary of "sarcastic" remarks, that it presents a weakness and a losing case. This is your circumstance exactly. I may state that you have neither reviewed the several important questions in the book, nor yet answered my letter with common-sense arguments. If "unbiassed" readers will carefully and thoughtfully peruse your criticism of my book, also your answer to my letter, they will readily see this for themselves. You have only criticised the fact that I obtained the information from certain sources, which I was honest enough to acknowledge. The arguments for or against the vital questions in the book you have left severely alone. Such questions are:—Season and workmen's tickets, system of fares, competition and combination, standard gauges, overhangs of cars, &c. Have you endeavoured to show where I am right or wrong as regards these questions? If you, or your great "expert," wish to argue these questions, then I am quite willing to hold my ground, and safely, too. In your opening remarks *re* your criticism, you say "that this book contains much wisdom," &c. This indirectly is flattering, for it at once proves that I am certainly capable of good judgement, as regards what is wisdom and what is not, and that I have sense enough to present wisdom to be read by interested people, which I am sorry to say is rarely done nowadays.

Now, you say that you engaged some great expert to review the book; I may tell you frankly that I do not for one moment believe that any expert outside of your own office wrote up that criticism and presented it "wholly" as it has appeared. He may have reviewed it; but, if so, you most certainly gave him some hints to work upon.

You make the statement that an outside expert reviewed the book. Will you please answer me the following which, on the surface, is "rather significant."

Now, I knew from a source over 200 miles from here that you yourselves condemned the book "*in toto*," when it had only been published some few days; also from a second source over 200 miles from the first I learnt the same thing. Is it possible that you had forwarded the book to an expert and obtained his review in about a week? It is not consistent. Then, again, supposing your reviewer had reviewed the book favourably. Is it likely that you would have inserted his favourable criticism when you yourselves had already made up your minds about it? If it was reviewed by an outside expert, you no doubt made the shot and he fired it. Now, regarding your expert, is he an engineer of a "private tramways company," or a "municipal manager;" if he belongs to the great monopoly who control all the lesser lights of private companies, then no doubt my ideas as regards non-compulsory powers prejudiced him. Then, again, is he one of those great engineers who has been installing 85-lb. rails, or rails bought in Belgium or Germany; also, one who has been using cheap cement or none at all in foundation structure? If so, he has great ability to judge any tramway book. Is he one who has been experimenting with that "fool's paradise," viz., workmen's and season tickets, &c., which I strongly condemn; if so, my remarks as set forth in the book will be rather unpalatable to him. Probably he has a book in hand (wholly original, of course) which I have forestalled. The Board of Trade recommend 90 to 100-lb. rails. I recommend in another book of mine 95 to 120-lb. rails (this is original); at the present time 108-lb. rails are being installed, which are approximately 10 per cent. "above" the maximum recommended by the B. of T. and 10 per cent. "below" my maximum. Is modern tramway practice moving towards my suggestions or otherwise?

You call my book a stone; but I may say that you have in the author (writer or compiler) of the book run up against a "huge rock," who is quite capable of taking care of himself, and who does not intend to lay down and die under any adverse criticism from prejudiced people. There are too many authors who are afraid to protest against the abuse and unfair criticism of "privileged" reviewers. I can stand my ground quite safely at any time, and with anyone. I may say that I can name at least half-a-dozen gentlemen whom, if they had been the writer instead of myself, would have obtained the greatest praise; but I, being apparently a "dark horse" of no consequence, receive your kicks. Sometimes a "dark horse" wins, as experiences have proved many a time. I can imagine the following dialogue taking place between the Editors of the Review when they receive my unpalatable letters:—

Monday morning, 10.30 a.m.

Mr. Alabaster: The mail contains another long letter from that "irrepressible" Bowker.

Mr. Gatehouse (in aghast): What, another?

Mr. A.: Yes; just read it.

Mr. G.: He certainly is a stickler.

Mr. A.: Well, what shall we do to be saved.

Mr. G.: We must once again put on an apparently bold front, so as to bluff our readers and appear in the right.

Mr. A.: Shall our note at the end be—(*a*) This correspondence is closed; (*b*) we have not sufficient space; (*c*) Mr. Bowker's letter is amusing; or (*d*) Yah! yah! yah!

Mr. G.: I think we will say, Yah! yah! yah!

Mr. A.: I think so, too; because he cannot possibly find an answer to Yah! yah! yah!

Readers will please note that the above subterfuges are frequently resorted to by editors who, when they are cornered, utilise such "sarcastic" (losing game) weapons to free themselves from further muddle.

Regarding my remarks *re* all "writers refrain," &c, this was a clerical error on my part, and should read "nearly all writers," &c.

Now, then, editors, please let us have your loophole for escape.

Wm. R. Bowker.

July 15th, 1904.

Re Telephone Wayleaves.

If you will permit a few words from me on a subject that I have had some dealings with, I shall be obliged.

Your article speaks of the difficulties of obtaining overhead wayleaves; I think I can give a clue to one of the causes of these difficulties.

A telephone company, desiring to pay a dividend, has to employ cheap labour, and as it is necessary that the outdoor linesmen should be good climbers, it frequently occurs that sailors, and men used to ship rigging, are employed.

Now what do some of these gentry do? They come and ask for a wayleave. Anxious to accommodate the use of the telephone the owner agrees. Up get our friends on the roof. They are armed with a hammer, a 1¼ in. auger, and the inevitable ½ in. chisel. It doesn't matter if the number of wires to be passed through a hole is one or fifty. Through goes the 1¼ in. auger, and a little putty covers a multitude of sins. The ½ in. chisel appears to be used indiscriminately as a screw-driver, a crowbar, or even a soldering bit, while the hammer is plied vigorously, but not always in the right direction.

While this is going on, our friends are indulging in a little conversation, which appears to be built up on the principle of the condenser, *i.e.*, English and adjectives sandwiched together. They also hail their friends (male and female) in the streets below in the same polyglot, and finally, having finished their job, they come down.

If you are a trusting individual, you take their word for it that it is all right, and consequently wait until the next rain storm, by coming through and ruining the ceilings you may have just decorated, throws some more light upon the operations; but if you have had experience, you insist on going up and having a look round for yourself, and when

you behold the cracked slates and tiles, the cementing knocked off, and the damaged gutters, it is no wonder if you feel like indulging in a little "polyglot" yourself.

Let me at once state, for the benefit of would-be critics, that the above cases are becoming much rarer, as a better class of men are being trained to the business. My sole object is to impress on the telephone, &c., manager, the necessity of carefully choosing his men, and very frequent inspection of them—that is, if he wishes to retain the goodwill of a large section of wayleave granters.

One of Your Appreciative Readers.

Re Protection for the P.M.G. of Australia.

Your writer on the above subject bases his criticism on an incorrect assumption; he would have taken a different view had he appreciated that the whole reason of the opposition was that the industry refuses to have its future progress retarded by rules formulated by any but an impartial body, and that, therefore, any rules drawn up by the postal authorities, not strictly concerned with the protection of the Postmaster-General's lines, are *ultra vires*.

One of the Conference.

Sydney, N.S.W.,
June 13th, 1904.

"Holtite" Jointing Material.—A reader wishes to know the name of the makers of this material.

PARLIAMENTARY.

Electric Lighting Provisional Order (Confirmation) Bill No. 7.

On Wednesday, July 13th, this Bill came before a Select Committee of the House of Commons, presided over by Mr. Agg Gardner

Mr H. Lloyd, K.C., appeared for the promoters. He explained that the Bill contained a number of provisional orders granted by the Board of Trade to the Clyde Valley Electric Power Co. The places to which the orders referred were as follows:—Barrhead, Johnstone, Renfrew, Shettlestone, Bothwell, Eastwood, Cathcart, Kilpatrick and Lanark. The orders relating to Bothwell, Lanark, and Johnstone were not opposed.

Mr. Robert Robertson, consulting engineer to the company, was called. He said that under the Companies' Act of 1901, Glasgow was excluded from their area of supply. Now Glasgow was asking for protection on account of certain gas and water pipes, &c., owned by it in Shettlestone, and further alleged that at some future date the districts in which it was opposing might be incorporated in the city of Glasgow. Special protection was asked for against electrolytic action. In his opinion there could be no electrolytic action under such circumstances as would arise from a supply of electricity for lighting purposes. In the case of a supply for power purposes, the branches for the high tension mains would be at such long intervals that it would be quite feasible so to place the mains that it would be impossible for any damage to be caused. If a house-to-house supply was being given, the mains would necessarily have to be close to the gas and water mains, but in that case the voltage would be so low that the question of damage could not reasonably arise. There was only one condition under which danger could arise, where tram rails were not properly bonded. Glasgow Corporation was asking for a space of 2 ft. to be left between any of its pipes and the company's mains, and yet he knew that in Glasgow itself the electric light mains were in some places actually laid in contact with gas and water mains, and even twisted round them. The Corporation further asked that the precautions should apply to any pipes laid in the future, and in regard to this he contended that the Glasgow Corporation was merely giving a supply of water and gas as a trader in the same way that the company was seeking to be made a trader.

Cross-examined by Mr. Browne, K.C. (for the Corporation of Glasgow), Witness disputed the statement that anything in the company's Act of 1901 would be rendered ineffective so far as protecting the Corporation was concerned.

Witness was also cross-examined by the Hon. J. D. Fitzgerald, K.C., for the Coatbridge and Airdrie Water Trust, who also oppose on the ground of possible danger from electrolysis.

Mr. Balfour Browne, K.C., and the Hon. J. D. Fitzgerald, K.C., having addressed the Committee on behalf of the opponents to the Bill, the Committee passed the opposed Orders, which, they said, must be read in conjunction with the Act of 1901. The clauses in the remaining Orders were then adjusted.

Electric Lighting Provisional Orders (No. 5) Bill.

This Bill came before the Unopposed Committee of the House of Commons on Friday last for confirmation of the orders contained in it. The orders were made by the Board of Trade under the Electric Lighting Acts of 1882 and 1888, the Electric Lighting (Scotland) Act, 1890, and the Electric Lighting (Scotland) Act, 1902, relating to Musselburgh, Portpatrick, and Wishaw.

Musselburgh Order.—This was an order granted to the National Electric Construction Co., Ltd., in respect of the Burgh of Musselburgh, in the County of Edinburgh. The area of supply was co-extensive with the burgh, and the undertakers were under the order required to lay down suitable and sufficient distributing mains for the purpose of general supply within a period of one year of the commencement of the order, and to maintain those distributing mains

Portpatrick Order.—This was an order granted to the Portpatrick Electric Supply Co The area of supply was so much of the parish of Portpatrick as was comprised within a radius of two miles from the Parish Church of Portpatrick. The order contained the usual provisions as to completion of works, &c.

Wishaw Order.—In this case the order was granted to the Provost, magistrates, and councillors of the Burgh of Wishaw, in respect of the whole burgh, which constituted the area of supply.

The three orders were formally confirmed.

Leith Corporation Tramways.

The Leith Corporation Tramways Order Confirmation Bill came before a Joint Committee of the Lords and Commons on Tuesday last week, the Earl of Camperdown presiding. Mr. Hutchinson appeared on behalf of the Leith Corporation, while the opponents of the Bill, the Edinburgh and District Tramways Co., were represented by Mr. Balfour Browne, K.C., and Mr. Forbes Lankester.

In opening the case for the promoters, Mr. Hutchinson stated that the order had been sanctioned by the Commissioners subject to the procedure of the Scottish Private Legislation Procedure Act. The order was to confirm the agreement which had been entered into between the Edinburgh Street Tramways Co. (not the petitioners, but another company) and the Corporation of Leith for the purchase of that part of the undertaking of the tramway company which lay within the borough of Leith. The order had already been considered by the Commissioners at the local inquiry, and, so far as the petitioners now appearing were concerned, their *locus* was objected to, and the Commissioners decided that they had no *locus*. He asked the Committee to confirm the opinion of the Commissioners on that point. Coming to the Bill itself, he said that in 1871 the Edinburgh Street Tramways Co. was incorporated and authorised to construct certain tramways in Edinburgh and Leith. One of the provisions of the Act then obtained was for the construction of tramways from Edinburgh to the Trinity district of Leith. However, in 1874 the company came to Parliament again, and obtained power to abandon the lines, but were required in lieu of tramways to put on omnibuses to cover the route. In 1884 another tramway company, the Northern Tramways Co., was incorporated, and they were authorised, among other things, to construct a line going from Princes Street, called the Goldenacre route; but by that Act the Northern Co. were required to take upon themselves the obligation of providing and continuing the 'bus service into Leith, which the Act of 1874 had imposed on the Street Tramways Co. That omnibus service existed to-day, and it was part of the tramway undertaking granted in 1884 to the Northern Co. In 1893, the Edinburgh Corporation, under the provisions of the Tramways Act, purchased the whole of the lines within Edinburgh. The lines which were in Leith still remained the property of the Street Tramway Co., and it was these lines which the Leith Corporation now desired to take over. In 1897 the Corporation of Edinburgh were authorised to purchase and work the undertaking of the Northern Co. The operation of the Act then obtained was to enable the Corporation, as they did in 1893 in the case of the Street Tramway Co., to step into the shoes of the Northern Co., and to take over their undertaking, so that they purchased as a statutory undertaking the tramway running to Goldenacre and the extension of the tramway so far as it was provided for by the omnibus service. In the 1897 Act it was provided that nothing in that Act should free or relieve the Corporation from the obligations imposed upon the Northern Co. by Sec. 34 of the Act of 1884. With regard to the system of omnibuses to and from Trinity, which obligation should transmit to the Corporation and their lessees, what the proviso said was that as a Corporation they were empowered to purchase those tramways, part of the tramways being an omnibus undertaking, and that neither they nor their lessees while they were in enjoyment of those powers should relinquish the omnibus undertaking. In 1897 the petitioners, the Edinburgh District Tramways Co., came upon the scene, and they leased from the Corporation of Edinburgh the whole of the Edinburgh Tramways, the Street Tramways, and the Northern Tramways. In 1898 a lease for a term of 21 years was granted. The petitioners appeared before the Committee and lessees, and he contended that unless the lease was approved by the Board of Trade it was not a lease complying with the provisions of the Act, though the agreement might have weight as between the lessee and the lessor, the petitioners and the Edinburgh Corporation. They could not make their lease avail against a third party. From his point of view the position of his learned friend was that he was the agent to work the tramways of the Edinburgh Corporation The second point was that his learned friend might establish that he had a lease which it was necessary for the Board of Trade to approve in order to make it valid; he came there as the lessee of his lessor, the Edinburgh Cor-

poration, who were not there to complain. Really his learned friend was seeking to alter the provisions of the Acts. In conclusion, he said that it was entirely unprecedented for a petitioner who was undertaking the obligation of working an undertaking under a lease to appear before Parliament on a Bill totally irrelevant to his lease, and to ask Parliament to authorise him to extinguish part of the property of his lessor, which he had undertaken to work. He therefore asked the Committee to say that the petitioners had no *locus standi* against the Bill.

Mr. Balfour Browne, K.C., then addressed the Committee on behalf of the petitioners. He said that in Edinburgh the tramways were taken over by the Corporation of Ediaburgh, and in Leith it was proposed to take them over under this order by the Corporation of Leith. The omnibus route was put upon the tramway company in substitution for tramways, and if they had made the tramways, instead of running the omnibuses, Leith Corporation would have been bound to have taken over the whole of the tramways in the district. The obligation put upon his company to run the omnibuses was an onerous obligation, but they had carried it out loyally, although they were making a loss on the 'buses. It was the question of competition which altered his position. The tramway along Pilrig Street was one proposed by the Corporation of Leith under the order, and that tramway would be a great disadvantage to the petitioners. The Corporation of Leith were proposing to take the traffic from the omnibuses, and yet they did not wish the petitioners to be heard against it. They were going to compete with omnibuses, which he was compelled to run, and which were being run at a loss. As a matter of fact, the petitioners were the lessees, and were working the whole of the tramways in Edinburgh, and their lessors did not deny that. The approval of the Board of Trade to the lease could be had if desired. The tramways, which had been inspected by the Board of Trade, were worked by his clients, who paid the Corporation £90,000 a year for the use of them. Under the circumstances he ventured to think that the Committee would say that he was entitled to be heard against the Bill, and he asked the Committee to make Leith undertake the running of the omnibuses.

Mr. Forbes Lankester remarked that the petitioners indemnified Edinburgh, and Edinburgh did not raise the question on the petition.

After consultation the Committee allowed the *locus*, the Chairman remarking that the question now was whether Leith ought to take over the 'bus route.

Mr. Forbes Lankester said that the substance of the clause which he was asking for, was that the Leith Corporation should not be empowered to take over the tramways, unless at the same time they took over the 'buses. Edinburgh Corporation was represented by counsel, who had instructions to support this. Witnesses were then called.

Mr. Hall Blyth, the chairman of the Edinburgh District Tramway Co., gave evidence as to the loss on the 'buses. Witness was cross-examined at some length by Mr. Hutchinson. Counsel differed from Witness as to the speed at which a certain cable was run, the Witness maintaining that it was run at nine miles an hour.

Mr. James Moore, of Edinburgh, was called by Mr. Hutchinson, and said that he did not think that the new route would increase competition. The line might not come into operation for some five years. There would be no means of communication with the Trinity district in that case if the company were released from their obligation to run the 'buses.

After consulting for some time, the Committee refused the clause proposed by Mr. Lankester, and the Bill was ordered to be reported to the House without amendment.

Supply of Electricity Bill.

(*Continued from page* 91.)

The Committee resumed on Monday, 11th inst., when the discussion of clauses was proceeded with.

Mr. Pelham said that on the previous Friday he had had a conference with the Municipal Corporations' Association and the representatives of the companies in reference to Clause 1, dealing with the compulsory acquisition of land for generating stations. To meet their views he now brought up three amendments to the clause. On the occasion of the last sitting of the Committee, Mr. Morse asked that power should be given to the Board of Trade to make provisional orders authorising undertakers to use existing sites—that was to say, not only to enable them compulsorily to acquire sites, but that they might use land which possibly they were using for another purpose, for the purpose of a generating station. The consequence of that would be to exempt them, to a certain extent, from actions for nuisance. The effect of the proposed amendment would go rather further, as it would enable them to specify land on which a generating station was already standing. It seemed doubtful to the Board of Trade at first, whether they should have power to make orders exempting those premises which were now liable to action for nuisance, from such actions. They had taken time to consider the matter, and had had the advantage of consulting counsel and the Chairman of Committees, and they felt that they could not draw any distinction between land which was vacant, and land on which buildings already existed. There was this to be said, that where a generating station was already existing, the people who went there knew what was going on, and if application was made for a provisional order, they would be more prepared to come forward and state their objections, than if it were a piece of vacant land on which it was proposed for the first time to erect a generating station. There was this point also—that if the undertakers applied to Parliament for Bills authorising an existing site or any site, the neighbours hardly knew what was going on, but in the case of provisional orders the Board of Trade could, and he would promise that they would, make some provision for notice to be given in the neighbourhood, so that anybody likely to be affected by the works would have an opportunity of stating their objections to the Board of Trade, and also finally to Parliament if the Bill went to a Committee.

Replying to Lord Stanley, Mr. Pelham said the amendments he proposed would in no way affect the question of compensation.

Mr. Freeman, K.C., said the effect of the clause would be to relieve undertakers from blackmail—not from the liability to compensation if they carried on their works in a negligent manner.

The amendments were then agreed to, including the following new section to Clause 1:—

"(4) The incorporation of the provisions contained in the schedule to the Electric Lighting (Clauses) Act, 1899, with a provisional order authorising the compulsory acquisition or use of land specified in the order for the purpose of a generating station, shall not have the effect of incorporating Sec. 81 of that schedule with so much of that order as authorises such acquisition or use."

On Clause 3, dealing with the question of supply in bulk, Mr. Pelham moved an amendment to insert the following words at the commencement of the clause:—"The Board of Trade may, *unless they are of opinion that, by reason of the character or magnitude of the proposed undertaking, the matter ought to be dealt with by private Bill*, authorise any company or person to supply electricity in bulk to any local authority, &c." He said that they had drafted that amendment in order to meet the objections made by Mr. Freeman that they should not grant very large schemes by provisional order.

Mr. Morse said he would rather that the amendment was not inserted, but that the matter was left in the hands of the Board of Trade. If the amendment was carried, promoters of large schemes would hardly know what position they occupied; they would be in doubt as to whether to go to Parliament straight away, or to the Board of Trade.

Mr. Pelham replied that he should think that promoters would come to the Board of Trade—say, in October—and consult them as to whether their scheme would have to proceed by Bill or not.

After some further argument, the amendment was agreed to.

Mr. Fitzgerald moved a further amendment to insert words which would enable a local authority to supply energy in bulk to a company outside its own area. He said that the Board of Trade had given notice of an amendment to enable local authorities to go outside their area to supply other local authorities, but they had excluded companies. He could not see why a municipality should not be allowed to sell to a supply company in an adjoining district. Surely, if they could supply a neighbouring local authority, they should be able to do the same for a company? If it was said that it was an extension of municipal trading, obviously as far as the local authority, which was giving the supply, was concerned, it was just as much municipal trading if they supplied a local body as if they sold to a private company. He hoped the Board of Trade would be able to make the clause apply to both local authorities and companies.

Mr. Morse said that the question had been brought before several Committees, and excepting in one very small case, Parliament had refused to allow a municipality to supply electricity in bulk outside its own area. The amendment, if carried in the Bill, would practically authorise a local authority to raise money on its own rates, which would be risked on undertakings outside its own district; and it would enable them to compete with companies which had powers outside their particular area. He did not think it was the intention of the Joint Committee, on whose report the present Bill was based, that such wide powers should be given to local authorities.

Mr. Cleese, representing the Notting Hill Electric Light Co., the Kensington and Knightsbridge Co., and the London Electric Supply Corporation, also opposed the amendment. He said that if it were carried they might have a local authority deliberately going for a provisional order, not with a view of supplying its own area, but with a view of supplying also a large area outside. Such a proceeding would be almost a prostitution of the powers of a local authority, and he hoped the Committee would disallow the amendment.

Mr. Hutchinson also opposed the amendment on behalf of the gas companies, and submitted that it was never the intention of Parliament that local authorities should be given powers to engage in trading operations outside their own areas.

Mr. Fitzgerald said it was only a question whether the Board of Trade should have power to confer the privilege upon local bodies—it was not compulsory on them. The Birmingham Corporation Act of last session gave similar powers.

Lord Wolverton: That was under an Act, not a provisional order.

Mr. Fitzgerald said the contention of counsel was that Parliament had never granted these powers, and therefore they said that the Board of Trade should not be given discretion in the matter. But the Birmingham Corporation Act was exactly a case in point, and he did not see why the Board of Trade should not be able to give the local authority the power, if they thought it expedient. Of course, each case would have to be decided on its own merits.

Mr. Pelham said that the power sought to be thrown upon the Board of Trade by the amendment was not recommended by the Joint Committee, and the Board of Trade thought that it was some-

what against the general policy of Parliament to authorise local authorities to go into those very large schemes of supplying outside areas. It might be dangerous, and result in a loss to the rates. They had gone as far as they thought right in suggesting that one local authority might be empowered to supply another local authority, which was a very much more limited thing than supplying a company.

The CHAIRMAN announced that the Committee had decided by four votes to one to strike out the amendment.

Mr. PELHAM, on behalf of the Board of Trade, moved to add words to the clause to authorise any local authority to supply electricity in bulk to any other local authority.

This was carried, and at the instance of the Board of Trade, the following words were also added to the section:—"For the purposes of this section 'undertakers' means:—(1) Any local authority, company, or person authorised to supply electricity; and (2) any authority having the management of the lighting of streets."

The Committee adjourned.

The Committee resumed on Monday, the 18th inst., Lord Wolverton again presiding.

On Clause 4 of the Bill, relating to the right of the local authority to purchase, the London County Council proposed the following in substitution for Sub-clause 2:—

"The power of the local authority to purchase an undertaking under Sec. 2 of the Electric Lighting Act, 1888, both as respects undertakings authorised before the passing of this Act and as respects undertakings authorised after the passing of this Act:—

"(*a*) Shall extend so as to authorise the purchase of any generating station, mains or other works used solely for supplying electricity for the purpose of the undertaking notwithstanding that the station, mains or works are situated outside the area of supply or outside the district of the local authority; but

"(*b*) Shall not extend so as to authorise the purchase by a local authority of any generating station situated in their district which is not used for the supply of electricity within some part of the district."

The Metropolitan Electric Supply Co. asked for the insertion of the following clause:—"Nothing in this section shall apply to any generating station established, held or used under the powers of any Act of Parliament."

After hearing counsel, the CHAIRMAN said that the Committee thought the following alternative words would meet the views of all parties:—"Provided always that any company coming under the operation of this clause may give six months' notice by resolution of the company to the Board of Trade that they will take none of the benefits and incur none of the liabilities under this Act."

Mr. T. W. PELHAM, for the Board of Trade, asked the Committee to accept the following in lieu of their own words:—"Povided that this sub-section shall not, without the consent of the company to which they belong, apply to any generating station, mains, or other works authorised by a special Act before the passing of this Act." He said that the Board of Trade had interviewed the companies interested in this particular matter, and they had practically agreed with the substance of his amendment. Their Lordships proposed to give all companies having generating stations outside their area the power to give notice to the Board of Trade that they wished to be exempted from the provisions of the Act. The result would be that they would be relieved from the obligation to sell, but they would also be deprived of certain advantages which they would derive under other clauses of the Bill. There were certain clauses in the Bill which, in the opinion of the Board of Trade, should apply to all companies—particularly those referring to the revision of maximum price; the certification of meters and the supply of electricity to premises having separate supply. There were other clauses which were proposed, not only for the good of the undertakers, but in the interests of the public. The Board of Trade thought it was desirable that the law should be as uniform as possible, but, of course, not uniform as regarded generating stations which had been built under special powers and under special Acts. It seemed very undesirable that the law affecting companies should be different, and under the proposal of the Committee the public generally would not know what companies were still liable, and what companies had given notice, and were, therefore, exempt. He submitted that the proposed procedure would be difficult in carrying out, because of its uncertainty, and was wrong in principle. The amendment he now brought up covered all the companies who claimed to be exempted from the powers of purchase. The companies who were present at the interview before the Board of Trade agreed with the principle of the amendment, but one or two of them rather suggested that they would prefer the proposal of the Committee, as that would exempt them from Clause 5 of the Bill, which enabled local authorities to purchase jointly; but he would suggest that it remained to be seen whether it was fair that they should be exempted from Clause 5. The proposed amendment of the Board of Trade carried out the intentions of the Committee with regard to Clause 4, without raising any of the difficulties which their Lordships' words might create.

Mr. MOON, K.C., said, that as far as the Metropolitan Electric Supply Co. was concerned, he was satisfied with either amendment, so far as Clause 4 was concerned, but he would prefer that the Committee's words should be adopted, because that would also relieve them from Clause 5. His clients would prefer to be out of the Bill altogther, but if they were in they must press for these exemptions as regarded Clauses 4 and 5.

Lord STANLEY: This amendment of the Board of Trade gives you more protection than you are willing to take.

Mr. MOON said that was hardly so. As a matter of fact, the Metropolitan Co. had got all the powers which this Bill contained under a special Act, and the Bill gave them nothing additional.

Mr. LEWIS COWARD remarked that the amendment of the Board of Trade hardly seemed to him to carry out the decision of the Committee.

The CHAIRMAN: The Committee are very much inclined to stick to the words of the resolution.

Mr. PELHAM appealed to their Lordships to accept this amendment, as otherwise, he said, the Board of Trade and the public would not know which companies were under the Act, and which were outside.

Lord STANLEY: You say that the public would not know which companies were exempt. The Board of Trade would know, and they would be able to notify all the local authorities.

Mr. PELHAM replied that the resolution of the Committee would be creating quite a new procedure, and it might apply to a hundred companies. The proposal of the Board of Trade was to limit it to those companies which had acquired a particular site by a special Act of Parliament for erecting a generating station. He believed there were only five such companies in London, and as far as the Board of Trade knew, there were none outside. There might be one or two, but they were not aware of them for the moment.

The CHAIRMAN: How far are you prepared to exempt these companies?

Mr. PELHAM: We are prepared by our clause to exempt these companies who have got suitable stations, absolutely from the power of purchase. That is all that they ask for, and we are agreeable to it. I am surprised at the L.C.C. objecting to our amendment, because it seems to me that we are more in favour of them than the resolution of the Committee.

Mr. PRITCHARD, on behalf of the Corporations, said they were prepared to accept the Board of Trade amendment.

Mr. MOON: What your Lordships give us is a great deal more protection than what the Board of Trade proposes to give us. I am satisfied to be out of the Bill altogether, or else I shall have to ask for exemptions on specific clauses.

Mr. BALFOUR BROWNE, on behalf of the electric lighting companies, said he agreed that the Board of Trade amendment took them out of Clause 4, but not out of Clause 5.

After deliberating for a short time in private, the CHAIRMAN announced that the Committee were prepared to accept the amendment of the Board of Trade.

Mr. PELHAM then brought up an amendment to the next part of Clause 4, so as to read: "The Board of Trade may, by a provisional order authorising a company, or person, to supply electricity in bulk only, exclude the application of the power of purchase given by Section 2 of the Electric Lighting Act, 1888, as respects the whole or any part of the undertaking authorised by the order." This was agreed to, as was the following new clause, inserted for the protection of the gas companies: "Nothing in this Act shall enable the Board of Trade by provisional order to authorise the compulsory acquisition of any land which, at the date of the first publication of the notice for the order, belongs to a gas company, and is used, or intended to be used, by them, for the purposes of their undertaking."

Mr. COWARD, on behalf of the L.C.C., moved to add the following new proviso to the clause: "Provided always that any local authority having power to purchase any part of an undertaking being wholly or partly within the administrative County of London may, subject to the provisions of this section, transfer such rights to the London County Council." He urged the Committee to accept the addition, in order to meet the peculiar position which London occupied in the matter of purchase, and said that all the Metropolitan local authorities were in favour of the L.C.C. having the power they sought by the amendment.

Mr. BALFOUR BROWNE, K.C., opposed the amendment, which he said practically amounted to altering the law, and making the L.C.C. the purchasing authority instead of the borough councils.

The CHAIRMAN said the Committee would accept the amendment provided that words were added making the transfer subject to the consent of the Board of Trade and the companies interested.

Mr. PELHAM opposed the amendment, and said the view of the Board of Trade was that, if the L.C.C. were to have any powers of purchasing and making concessions, they should be exercised over the whole of the county, and not in parts.

Mr. COWARD: Subject to your consent, Mr. Pelham.

Mr. PELHAM: Well, we should never give our consent.

Mr. COWARD: We are prepared to take the amendment even with the addition of those words.

The amendment was then carried with the additional words suggested by the Committee, and Clause 4 as amended, was agreed to.

On Clause 5, relating to the exercise of electric lighting powers by authorities jointly, Mr. Moon proposed the following addition:—"But no such order shall be made affecting any area in which any company is supplying, or authorised to supply, electrical energy for power or lighting purposes otherwise than with the consent of such company." The amendment was rejected, and the clause adopted.

On clause 6, dealing with the consents of local authorities to the grant of provisional order, the following was added at the end of Sec. 1, at the instance of the Board of Trade.

"Provided that—

"(*a*) This sub-section shall not apply to any provisional order authorising a company or person to supply electricity so far as the order relates to any district in which the local authority is authorised to supply electricity; and

"(*b*) A provisional order authorising the breaking up of roads outside the area of supply, shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade, in any case in which the consent of any such local authority is refused, are of opinion that, having regard to all the circumstances of the case

such consent ought to be dispensed with, and in that case they shall make a special report stating the grounds upon which they have dispensed with such consent."

Sub-section 2 of the clause, repealing Section 1 of the Electric Lighting Act, 1888, from the beginning of the section down to "with such consent," was, at the request of the Board of Trade, omitted from the clause.

The electric lighting companies asked that Clause 7 of the Bill should be amended by leaving out the words, "and allowing representations as to revision to be made by consumers." They also asked that Sub-section (*a*) which enables the revision of prices to take place at an interval of five years after the commencement of the Act or order, or the last revision in cases where a longer interval is fixed should be omitted, and that Sub-section (*b*) which enables the power of revision or variation to be exercised on the representation of such numbers of consumers as the Board of Trade may consider sufficient should also be omitted. These amendments were lost, as also was a proposal by the companies to insert at the end of the clause the following words: "If the Board of Trade consider any such representation of consumers to be frivolous or vexatious, they may direct the costs of the undertakers occasioned thereby to be paid by such consumers." The clause was then agreed to.

Clause 8 of the Bill, relating to the certification of meters, was carried, with the addition of the following words at the end, to meet the wishes of the Committee:—

"(*d*) Sec. 51 of the same schedule (which requires inspectors to certify meters) shall be read as if at the end there were added, 'and the inspector shall, on the like requisition and payment, examine the manner in which any such meter has been fixed and connected with the service lines, and shall certify that it has been fixed and connected with the service lines in some manner approved by the Board of Trade, if he considers that it is entitled to be so certified.'

"And an electrical inspector, on being required to do so by the undertakers or by any consumer, and on payment of the prescribed fee by the party so requiring him, shall examine the manner in which any meter has been fixed and connected with the service lines, and shall certify that the meter has been fixed and connected with the service lines in some manner approved by the Board of Trade, if he considers it to be entitled to be so certified."

The Association of Municipal Corporations brought up an amendment to Clause 10, to insert after the words "a person shall not be entitled to demand," the words "or to continue to receive," and this was allowed, an amendment by the London County Council to omit the clause having been refused.

The clause, as amended, was then agreed to.

Clause 11 was amended to read as follows:—"So much of any provisional order or special Act, or of the schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any such Order or Act, as prohibits undertakers from associating themselves with any company or person for supplying energy under any licence, provisional order or special Act unless the undertakers are authorised by Parliament to do so, shall not be construed as prohibiting the undertakers from giving or taking a supply in bulk to or from any such company or person."

Mr. Lewis Coward, on behalf of the London County Council, moved the following as a new clause after Clause 9:—

"1. If any auditor appointed by the Board of Trade to audit any accounts of any undertakers shall find such accounts incorrect in principle or in detail, he shall require such undertakers to correct such accounts in such a manner as he thinks right, and no future dividend shall in any case be declared by any such undertakers until their accounts are certified by the auditor.

"2. If any undertakers think themselves aggrieved by any act or determination of the auditor, the matter in difference shall be referred to the determination of an arbitrator agreed on between such undertakers and the auditor, or in default of agreement appointed on the application of either party by the Board of Trade, and subject to this provision such undertakers shall observe and abide by the directions and determinations of the auditor."

He said that at the present time, although an auditor was appointed by the Board of Trade to audit the accounts, he had no power to enforce any objections which he might take to the accounts. There were many items which might be charged to capital account when they should not be so charged, as it stood the companies had declined always to comply with the suggestions of the Board of Trade auditors. The matter was of importance to local authorities in two ways. First, with regard to the periodical revision, and, secondly, in view of the purchase of undertakings by local authorities. In the latter case, it was extremely important to keep proper accounts. Incorrect accounts might alter the value of property to the extent of several thousands of pounds. There were no methods by which the recommendations of auditors could be enforced except by means of a penalty similar to that imposed under the Metropolitan Water Act of 1871.

Mr. Pelham (Board of Trade) said that while it was true that there was no power to enforce the requirements of the auditors, yet it could not affect the question of purchase, because a local authority purchased at the price of the actual material.

The amendment was refused.

The Metropolitan Electric Supply Co. submitted the following new clause:—"Nothing in this Act shall extend to or authorise the making of any provisional order which shall affect the undertaking, works, rights, powers, or privileges of any existing company having powers under a special Act of Parliament." The clause was refused, the Chairman remarking that it altered the whole principle of the Bill, and the Committee could not accept it.

A clause brought up by Mr. Hutchinson on behalf of the gas companies having been disposed of, the Bill was ordered to be reported.

Tyneside Tramroads and Tramways Bill.

On Tuesday the Select Committee of the House of Commons, presided over by Sir E. Strachey, met again to consider the Tyneside Tramroads and Tramways Bill, which had been sent back to them by the House of Commons for the question of the running powers by the company over the tramways of the Newcastle-on-Tyne Corporation to be reconsidered. Mr. Balfour Browne, K.C., and Mr. Macassey appeared for the company, and Mr. Lloyd, K.C., and Mr. Talbot for the Newcastle Corporation.

Mr. Balfour Browne said he was glad to say that the Corporation and the company had come to terms. He did not want to go into old matters, but it was an unfortunate thing that the Corporation did not take the same view that the Tramways Committee of the Corporation took of the agreement in August, 1903. If they had done so, they would not have had to come before Parliament at all. Now the Corporation had come to what he would call a proper sense, and were willing to agree to the Tramway Committee's report of that date, and that had been embodied in an agreement which was sufficient for the purpose. He was anxious that there should be no going back on the agreement, and he proposed that the agreement should be scheduled with the Bill. If it went back to the Corporation for confirmation, it might be that it would have to come again before the Committee. This had been agreed upon between the Corporation's solicitors and the company's solicitors, and he thought it would be better to put it in the Bill as it stood. It would never be a precedent, for the case was unique; they knew how difficult it had been to arrive at an understanding, and therefore it would be better to take the words which had been agreed upon.

Mr. Lloyd said they regarded it as rather an unsatisfactory way of carrying out an arrangement, that the heads of the agreement should be scheduled, because the wording was not artistic, and not such as was generally put into a Bill. He thought that it would be better that these terms should be put into a final agreement, and scheduled in the Bill. There was no difficulty about this, because the heads of the agreement had been before the Newcastle Corporation, and had been agreed to. Unless the thing was put into a legal form, many difficulties would occur. Another matter was that the Committee suggested that the parties should draw up and submit a clause to provide that in case of the sale of the company's undertaking, no increased value should accrue in consequence of the agreement. That appeared in paragraph 26 of the heads of agreement, but if they scheduled that as one of the heads of agreement and did not put it in as a clause, the effect was almost nugatory. Paragraph 15 make the heads of agreement binding between the parties, and the result was that if this non-enhancement clause was left as an agreement between the parties, and was not inserted in the Bill as a separate clause, it would be binding upon the Corporation and the company, but it would be no good whatever to the local authorities who would have power to purchase. He accordingly suggested that it would be well for the Committee to allow time for the final agreement to be drawn up, and for a clause relating to value to be submitted.

Mr. Balfour Browne said he would rather stick to the idea of embodying the heads of agreement. Clause 23 said that the terms were to be embodied in the form of an agreement, and if they embodied that, it would have the effect of an Act of Parliament. If any formal agreement was necessary, that was provided for by paragraph 23 of the heads of agreement. He was not quite certain what the Committee wanted with regard to the clause as to no value accruing to the undertaking by reason of running powers being granted. No enhanced value could accrue as between the company and the Corporation. If they put in a non-enhancement clause, it would be for the benefit of the people outside who did not ask for it.

The Chairman: That makes no difference to us. We think your company ought not to get enhanced value in consequence of these running powers.

Mr. Balfour Browne said that would be the effect of the embodiment of the heads of agreement. Directly the undertaking was purchased by Wallsend or any other local authority, the agreement with the Corporation became dead. There would no longer be any running powers, and consequently no enhanced value.

Mr. Lloyd said there was nothing to prevent the Corporation and the company agreeing together as against the other authorities.

After further discussion, the Chairman said the Committee had come to the conclusion that it was desirable that the agreement itself should be embodied in the Bill, and that a separate clause should be inserted with reference to the non-enhanced value of the undertaking in consequence of running powers being granted. They would adjourn till Friday to enable the agreement to be drawn up and embodied in the Bill, but it must be clearly understood that the Committee intended to finish the matter on Friday.

Lothians Electric Power Bill.

The Chairman of Ways and Means, reporting from the Committee on the Lothians Electric Power Bill, states:—That the object of the Bill is to incorporate a company and confer powers upon them to provide central electrical generating stations and supply electricity, principally for manufacturing and trade purposes, in the county of Mid-Lothian, or county of Edinburgh, and certain parishes and places in the counties of East Lothian, or county of Haddington, and in the counties of Peebles and Lanark. A report from the Board of Trade, in pursuance of Standing Order No. 157A, was laid before the Committee and considered by them, but the recommendations contained in such report appeared to have been carried out in the Bill as passed by the House of Lords. It is proposed by the Bill to authorise the payment of interest out of capital

during the construction of works, but it was proved to the Committee that such payment would tend to facilitate the raising of the capital, especially locally, and although the clause relating to such interest had been inserted, subject to the conditions prescribed by Standing Order No. 167, they recommend that payment of interest should be allowed, notwithstanding the fact that the said Standing Order No. 167 only related to railway Bills. There are no other circumstances of which, in the opinion of the Committee, it is desirable that the House should be informed.

Electric Lighting Provisional Order Bill (*No.* 8).—This Bill, to confirm orders granted by the Board of Trade to the local authorities of Caerphilly, Mansfield Woodhouse, Stroud and Dursley, and Sutton-in-Ashfield; to the Surrey Electrical Power Distribution Co. in respect of Cheam; and the Shropshire and Worcestershire Electric Power Co. in respect of Bromsgrove, came before a Select Committee of the House of Commons on Monday. All the orders were confirmed except that in regard to Stroud and Dursley.

LEGAL.

Corporations and Electric Tramway Companies.

Mr. Justice Phillimore, in the King's Bench Division of the High Court of Justice on Wednesday, 13th inst., delivered judgement in the action of the Norwich Corporation against the Norwich Electric Tramways Co. The action was heard at the late Norwich Assizes, and it was nominally to recover a sum of £53 odd, money paid by the Corporation for the repair of roads said to have been injured by the defendant company.

Mr. MacMorran, K.C., and Mr. Wild, were counsel for the Norwich Corporation, and Mr. Low, K.C., and Mr. Hemle appeared for the defendant company.

His Lordship, in delivering judgement, said that in addition to the £53 13s. 10d. claimed by the Corporation, both parties sought a declaration from him as to their respective rights under Sec. 57, Subsec. 5, of the Norwich Tramways Act, 1897. By the Tramways Act, 1876, Sec. 28, the Electric Tramways Co. had to keep in good condition and repair to the satisfaction of the local road authority (1) so much of the road as lies between the road lines of the tramway; (2) if there were two tramways belonging to the same tramway company within 4 ft. of each other, the portion of the road between these two tramways; (3) so much of the roadway as extends 18 in. beyond the rails on each side of any such tramway. By the same section, if the Tramways Co. failed to comply, the Corporation might, after seven days' notice, open and break up the road and do the necessary works at the expense of the Tramways Co. with interest at 5 per cent. The Norwich Act incorporated these provisions of the General Act, and it also contained certain provisions which probably were the result of a Parliamentary bargain between the city of Norwich and the Tramways Co. Sec. 53 provided that whenever the road authority, which was the Corporation in this case, altered the level of any road on which the tramline was laid, the company should at the same time alter its rails, so that the surface of the rails should be on a level with the altered surface of the road. If this was not done and the lines of rail got out of level so as to be a danger to public traffic, a penalty of £5 10s. a day could be imposed. It was further provided that when the street was so narrow that there was a less space than 3 ft. between the footpath and the tramway rails, the company should pave and maintain the road. This imposition of a penalty and the obligation in the case of narrow streets were additions to the law under the general Act. There were provisions also that if the company failed to maintain and keep in good condition to the satisfaction of the Corporation (1) so much of any road whereon any tramway belonging to them is made as lies between the lines of the tramway; (2) the portion of the roadway between the tramways where the lines of the tramways are laid by the company in any road; (3) so much of the roadway as extends 18 in. beyond the rails of and on each side of any such tramway; (4) the whole width of the tramway where any tramway shall have been constructed in any street so that a less space than 3 ft. intervenes between the outside footpath at either side of such street and the nearest rail of such a tramway; (5) the junction of the paving laid and maintained by the company, with the surface laid and maintained by the Corporation, the Corporation may, if they think fit themselves at any time after seven days' notice to the company, do the work necessary for the repair and maintenance of the road, and the expense reasonably incurred by the Corporation in so doing shall be repaid to them by the company, with the addition of 5 per cent. of such expense. The state of things to which he was asked to apply the sub-section was this: The tramways in some cases were laid in streets paved with wood, and about these no question arose. In other cases the roads were made with macadam, the tramways being laid in granite setts, which had a line of granite setts next the road. The life of a granite sett was about 20 years, and that of a macadam road averaged four years, so that, at the point where the macadam became worn lower than the granite, a ridge or trough was formed into which the wheels of vehicles went, and formed a trough in which water accumulated, making the macadam rotten and soft. The Corporation had to repair these ridges, &c., but the tramways company said it was necessary to do the repairs because the surface of the macadam was bad, and the whole of it was in need of repair. In some cases he was satisfied that the macadam might have been in better repair, but in the greater number of cases it was in sufficiently good repair. The sum in dispute for the work done by the Corporation was small, but the great object was the ascertainment of a principle to guide them in future. What they had to consider was what was to be done when the macadam had still some years of life, but was worn down appreciably below the surface of the setts. The Corporation said the company should pay the cost of the repairs in such cases, but the company said the road should be maintained by the Corporation in such circumstances. The Sub-section was certainly difficult to construe, but, on the whole, he thought that the fact that macadam wore away more quickly than granite, had been considered in the legislation that had been carried out, and that it was intended to throw upon the tramway companies, as a condition of the privileges given them, the duty of maintaining the even contour of the road by a proper junction of the two surfaces. He, therefore, gave judgement for plaintiff Corporation for £53 13s. 10d., with 5 per cent. interest. As to the proposed declaration, he had asked each party to forward him in writing the form they wished it to take. Having read these forms of declaration, his Lordship said he should make a declaration in favour of the Corporation, in terms slightly altered from the form proposed by them. It read as follows:—"That the obligation of the company, under Section 57, Sub-section 5 of the Norwich Electrical Tramways Act, 1897, to maintain and keep in good condition the junctions therein mentioned extends to cases, where, by reason of the presence of the tramways in a road, the traffic in such road has caused the surface, laid and maintained by the Corporation, to become worn down below the level of the paving laid and maintained by the company, and involves the maintenance by the company of a uniform and unbroken contour of such surface immediately adjoining such paving or the lowering of the pavement itself."

On the application of Mr. Low, stay of execution was granted on the usual terms.

Electric Tramways Construction and Maintenance Co, Ltd.—Petition of A. J. Paine.

This matter again came before Mr. Justice Buckley in the Companies Winding-up Court on Tuesday, 12th inst.

Mr. Norton stated it was a shareholder's petition which the late Mr. Justice Byrne directed in March last to stand over for 14 days pending an action by the company, for the rectification of the register by striking out the shareholder's name, being decided. There had been repeated postponements of that trial, which was finally set down for trial before Mr. Justice Kekewich on Monday next.

In the result it was arranged that the petition should stand over till the second motion day next sitting, in view of the uncertainty of certain criminal proceedings now pending. Two summonses relating to the company, also in the same list, stood adjourned for the same period.

Electric Tramways Construction Co. *v.* Paine.

In the Chancery Division on Monday application was made to postpone the hearing of this case till after the Long Vacation on the ground of the criminal proceedings no pending. The application was granted.

Kay *v.* The British Westinghouse Electric and Manufacturing Co.

This case came before the Court of Appeal composed of the Master of the Rolls and Lord Justice Mathew on Saturday on an application on behalf of the defendants for a stay of execution pending appeal.

Mr. Ellis Hill, for the defendants, said that the action was tried before Mr. Justice Jelf and a special jury at the Manchester Assizes. The plaintiff, an employé of the defendants, brought the action to recover damages in respect of personal injuries caused by his falling against an electric switch, part of the electric lighting apparatus of the factory, and getting burnt by the current. The plaintiff's case was that the defendants had been guilty of negligence, and that they had committed a breach of duty under the Factory Acts. On the point under the Factory Acts, the learned Judge came to the conclusion that the switch in question was not part of the machinery within the meaning of the Factory Acts. He left, however, the question of common law negligence to go to the jury. The point on which he (counsel) asked for a stay was this:—The defendants set up the defence of common employment, and they proved that the whole of the works of defendants, so far as the technical part of it was concerned, was handed over to the general manager, and a man named Harris. There were 1,300 switches in the factory, and all but five were covered. The switch in question was uncovered, and, therefore, the accident happened. He submitted that the defence of common employment was a good defence against the claim at common law. The learned counsel, in answer to Lord Justice Mathew, said that the jury awarded the plaintiff £850 damages. He said that the defendants were willing to pay plaintiff £1 a week until the appeal was heard.

Mr. F. Newbolt said that the amount offered by his learned friend was not enough. Plaintiff had been most seriously injured. He had lost one eye, and would not be able to do another stroke of work as long as he lived. He had also an invalid wife. Plaintiff's earnings had been £1 10s. per week.

Lord Justice Mathew said there seemed to be a real question of law to be discussed.

In the result their Lordships directed that there should be a stay until the hearing of the appeal, on the defendants paying plaintiff £1 a week, to reckon from the date of the accident until the appeal was heard, and paying the plaintiff's solicitor's costs on the usual undertaking.

TRAMWAY TEST CASE AT SHEFFIELD.

BEFORE the Sheffield Stipendiary yesterday, Mr. Muir Wilson, solicitor, who is a city councillor, was charged with failing to show his tramway ticket to a servant of the Corporation, on demand, and with refusing to pay the additional 1d. fare which he was liable to pay under the circumstances. Mr. Bairstow appeared to prosecute, and Mr. Wilson conducted his own case. Mr. Wilson, it was alleged, refused to accept a ticket owing to there appearing on the back thereof a notice limiting compensation in case of accident to £25. He contested the validity of such notice.

Mr. BAIRSTOW said a passenger must abide by the Corporation's conditions.

Mr. WILSON said the object he had in raising the question was, that the Corporation were endeavouring to impose on the citizens, through their chairman, a condition which was wild and extravagant, and so unjust that he would not tolerate it until a Court of Law said he must. The condition was not a bye-law, but merely a resolution of the Tramways Committee, confirmed by the City Council. It had never been submitted to the Board of Trade.

Alderman CLEGG, chairman to the Tramways Committee, was called by the defendant. He said the condition was passed to protect the Corporation against imposition and exaggerated and unfounded claims. The Committee would not make any cavil respecting the payment of compensation where the claims were just and fair.

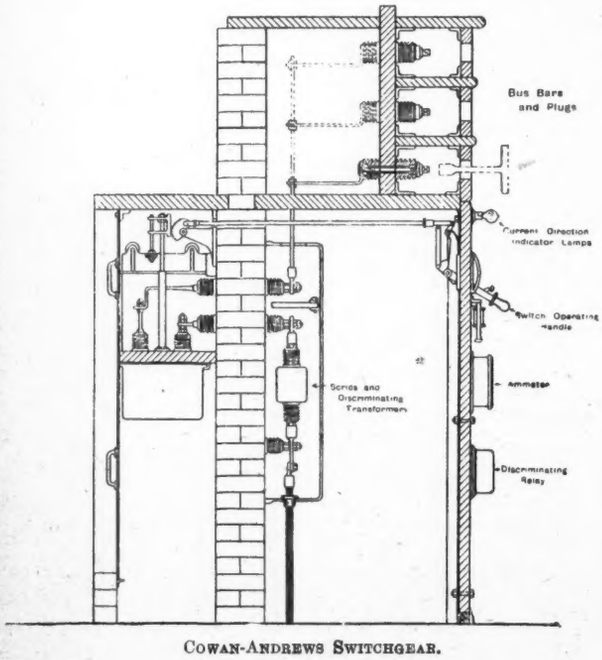
The STIPENDIARY thought the requirements of the bye-law for showing the ticket had been complied with, but as regarded delivering and producing the ticket he must convict.

A fine of 1s. was imposed upon Mr. Wilson for failing to produce and deliver his ticket, and an additional penalty of 1s. for failing to repay the 1d. fare.

Notice of appeal was given.

BUSINESS NOTES.

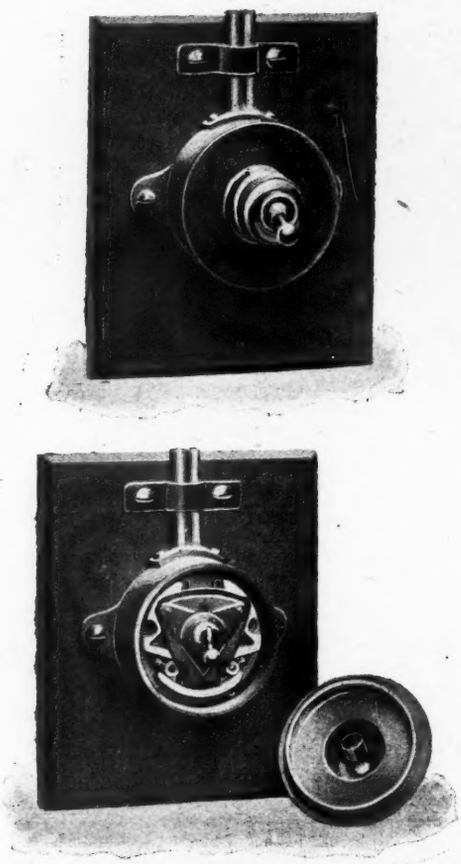
Cowan-Andrews Switchgear.—Messrs. Cowans, Ltd., have sent us a handsomely produced souvenir of the demonstration which took place at their London showrooms last May. In addition to the illustrations and description which were abstracted in our issues of June 3rd and 10th, 1904, a cross-section of their standard arrangement of high-pressure switchgear as modified for small installations is included in the souvenir, and as it presents some interesting features we reproduce it herewith. It will be seen that no high-pressure conductors are accessible on the front of the



COWAN-ANDREWS SWITCHGEAR.

board; the instrument transformers are readily accessible in compartments in the gallery behind the board, and the high-pressure oil-switches are completely isolated by a brick wall from the rest of the switch gear. Moreover, any switch, with the corresponding apparatus, can be isolated from the bus-bars for inspection or repair by means of screw plugs, arranged so as to break connection in separate compartments, isolated by brick walls and soapstone slabs from one another. The arrangement of the Cowan-Andrews discriminating apparatus and current direction indicators is also indicated.

A Novel Watertight Tumbler Switch.—To get over the difficulty which has always presented itself when using tumbler switches for out-door work or in exposed positions where moisture is present, the General Contracts Co., Ltd., have recently put on the market a novel form of their patent "Strut" switch enclosed in a watertight box. To facilitate manufacture, the standard type of switch is used complete, secured in the metal box, either with or without the cover, as may be desired, and so as to retain the full advantage of the tumbler action and at the same time produce a switch that is absolutely watertight, a second dolly is introduced working in a ball and socket joint in the cover of the watertight box. The second dolly carries a cupped end, which fits over the ball of the permanent switch dolly, thus forming a smooth working joint between the outer dolly and the switch lever. For convenience in coupling up, the wires are carried through glands in the side of the box, so arranged as to give sufficient length of wire to allow the



WATERTIGHT SWITCH, WITH AND WITHOUT COVER.

switch being removed for making the connections, sufficient space being allowed in the bottom of the box to stow the slack wire when the switch is fixed in position. The additional dolly and outer cover being concentric with one another, admit of the cover being unscrewed with the switch in any position, and as there are no small screws or loose parts in connection with this portion of the case, which have to be removed when making the wire connections, and so interfere with the adjustment of the watertight joint, the switch is very simple and effective. The switch is constructed to take any form of gland or other tube connection, and is manufactured under the company's patents.

Electricity in Cotton Mills.—We have received from Messrs. Kelly & Hide, consulting electrical engineers, Liverpool, a copy of a paper read by Mr. A. Kelly in December last before the Manchester Insurance Institute. The author reviews the progress which has been made in the application of electrical driving to cotton mills, and describes examples of its use in the United States for this purpose. Instances of the driving of spinning frames, looms, &c., both direct and by belt, from electric motors are given, and the reasons for the superiority of electrical over mechanical driving are explained. It is stated that the cost of repairs in a mill which has been electrically driven for 9 years has amounted to only £5 per annum, the installation comprising plant of 1,380 H.P. The transmission efficiency is stated to be 82 to 84 per cent., com-

pared with 75 per cent. with rope drives. In large mills the electrical installation is actually much cheaper than the mechanical. The increased output due to the adoption of electrical driving is estimated by mill owners who have tried it, at 4 per cent. on weaving, and 6 to 8 per cent. on spinning. The lessened cost of the buildings with electrical driving is a very important item, and the ease with which extensions can be carried out is a valuable feature. The paper is well worth studying on the part of those interested in this large field for electrical development.

Single-phase Induction Motors.—The simplicity and good speed regulation of the induction motor, and the fact that it requires practically no attention, are qualities which ensure its popularity amongst non-technical users, as well as in places where skilled attendance is available. To meet the demand for such motors of the single-phase type, the British Thomson-Houston Co., Ltd., of Rugby, are issuing particulars of their standard types, the appearance of which will be gathered from our illustrations.

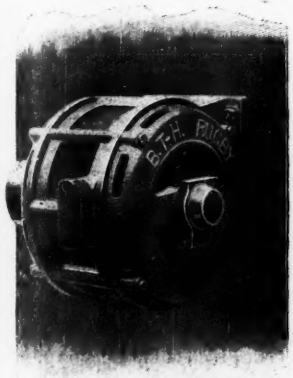


Fig. 1.—AIS 7/15 Form K Induction Motor.

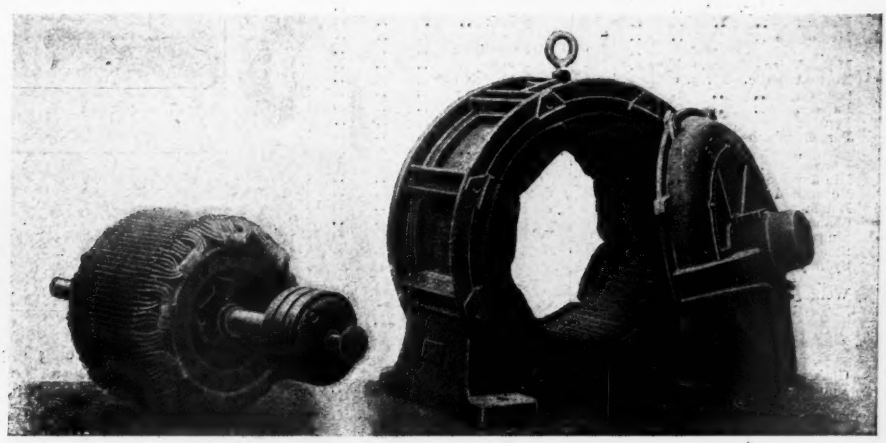


Fig. 3.—Parts of Form M Induction Motor.

Form K, supplied in sizes up to 4½ H.P., has a squirrel-cage rotor, and is started with a phase-splitting device which limits the current to 1¼ times the full-load current. Fig. 1 shows one of this type attached to a wall; it can equally well be mounted on the floor or ceiling, the end shields being rotated so as to keep the oil wells below the shaft.

Form M, which is supplied in larger sizes, has a wound rotor with slip rings and carbon brushes, and is started with resistance in the rotor circuits, combined with a phase-splitting device which gives from ⅓ to ½ full-load torque, with full-load current. Fast and loose pulleys, or an automatic clutch pulley, can be supplied when

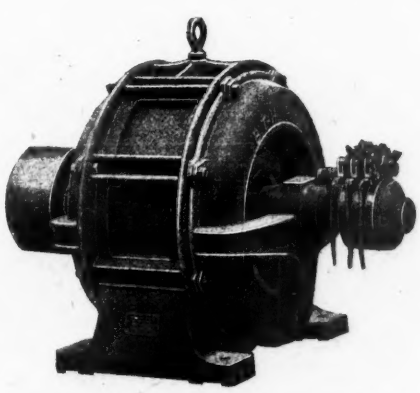


Fig. 2.—AIS 15/32 Form M Induction Motor.

it is necessary to start on a larger load. Fig. 2 shows the motor complete, and fig. 3 the parts before assembly. The rotor, as shown, is provided with a device for short-circuiting the slip-rings when normal speed is attained. The standard motors are wound for 100 and 200 volts, at 50 cycles per second. The temperature rise of the partially enclosed type for continuous running at full load is not more than 63° F. on the smaller, and 72° F. on the larger sizes, by thermometer, or 72° F. and 81° F. respectively when totally enclosed. The motors are capable of taking 50 per cent. overloads for short periods.

The efficiency of the motor shown in fig. 2 is 82 per cent. at full load, and the power factor 83 per cent. The largest form K motor, giving 4½ H.P., has an efficiency of 80 per cent., and power factor 81 per cent. at full load.

The Telegraph Cable Export Trade.—June was a very quiet month as regards the exports from this country of telegraph cables and apparatus connected therewith, the shipments attaining a value of only £52,334, as compared with £171,760 in May last, and £76,721 in June, 1903. The quietness which has so far this year prevailed in this branch, is well shown by the returns for the six months ending with June, the exports during that period having amounted to only £513,359, as contrasted with £1,438,854 in the first half of last year.

Proposed International Exhibition.—The question has been raised by the *Magazine of Commerce*, "Shall we hold a Great International Exhibition?" The opinions of a large number of important business firms have been obtained, and appear to be pretty well balanced *pro* and *contra*. It is argued that a Free-Trade country has no use for an exhibition, which merely helps foreign firms to copy our methods; on the other hand, it is pointed out that this argument cuts both ways.

Electric Power in Australia.—The Electric Lighting and Traction Co. of Australia, Ltd., inform us that good progress is being made in the development of electricity supply for power purposes in Australia. The figures obtained at the end of April for their various stations were as follows:—

Station.	Year of working.	H.P. of motors connected and applied for.
Melbourne	5th year	404 H.P.
Adelaide	3rd ,,	541 ,,
Geelong	3rd ,,	332 ,,
Total H.P. of motors		1,277 H.P.

A pamphlet has been issued by their engineer and manager, Mr. F. W. Clements, which at the same time clearly explains the advantages of the electric motor in point of simplicity, convenience and economy over all other motive power agencies, and shows the skill attained by Australian printers by the excellence of its production. In addition to an eloquent discussion of the subject of electric motive power, the pamphlet includes a list of some 220 Australian installations in which it is employed in connection with the company's supply, in very many of which electricity has displaced steam, oil or gas power, with the number and size of motors, the cost of electrical energy per month, and the nature of the industry concerned.

How to Advertise.—Messrs. Frank Gould & Co., of 54, New Oxford Street, W.C., have sent us a little book, entitled "Some Notes on Advertising," which is forwarded gratis by the publishers to intending advertisers, to enlighten them on the best and most fruitful means and methods of organising an advertising campaign. Advertising is as much an art as any other department of business activity, but in this country it is too often undertaken by inexperienced persons, who fail to make the best use of the space for which they pay; not only how to advertise, but when and where to advertise, can only be ascertained by experience. The booklet contains a pretty full list of the representative publications of the world, which should be of great utility to business men.

Electro-magnetic Sorting Machine.—A machine for sorting the refuse of machine shops, made by the E. H. Geist Electrical Works, Ltd., of Cologne, is being introduced by Messrs. B. Kuettner & MacDonell, of 3, Adam Street, Adelphi, W.C. A bell-shaped magnet is used, in the field of which the turnings, &c., are automatically distributed by a hopper and oscillating cylinder. The machine sorts about 16 cwt. per hour of miscellaneous scraps and turnings, but the output may be greater or less according to the nature of the mixture; it can also be used for sorting granulated slag, iron ore, &c.

Electrical Wares Exported.

Week ending July 14th, 1903.

Alexandria	Value £109
Auckland	103
Beira	41
Bombay	86
Bordeaux	65
Boulogne	39
Buenos Ayres. Teleph. mat.	593
Calcutta	2,597
„ Teleg. mat.	250
Cape Town	1,063
„ Teleg. mat.	1,096
Channel Islands	32
Colombo	440
„ Teleg. mat.	90
Delagoa Bay	239
Durban	507
East London	903
Flushing	20
Fremantle	56
Hong Kong	2,732
La Plata	50
Madras	261
„ Teleg. mat.	32
Malta	12
Melbourne	333
„ Teleg. mat.	650
Monte Video. Teleg. cable	190
North Atlantic. Teleg. cable	4,000
Otago	248
Paris	197
Penang	965
Port Elizabeth	45
„ Teleg. mat.	74
Rangoon	50
Rio Janeiro	160
Rotterdam	80
Rouen	24
Shanghai	264
Singapore. Teleg. mat.	98
Stockholm. Teleg. cables	178
Sydney	1,560
„ Teleg. mat.	482
Wellington. Elec. cable	3,580
Total	£24,595

Week ending July 12th, 1904.

Amsterdam	Value £26
Bombay	48
Buenos Ayres	245
Calcutta	255
Callao. Teleg. mat.	150
Cape Town	308
„ Elec. machinery	545
„ Teleg. mat.	147
Christiania	88
Colombo	120
Copenhagen	62
Delagoa Bay	28
Durban	1,906
„ Elec. machinery	346
East London	624
„ Teleg. mat.	92
Fremantle	265
„ Elec. machinery	100
Gibraltar	137
Halifax	22
Hamburg. Teleg. mat.	170
Hong Kong	834
Iquique. Teleg. apparatus	300
New York	20
Perth	388
Port Elizabeth	79
Rangoon	54
St. John's (N.F.)	91
St. Petersburg	120
Sarawak	4
Shanghai	67
Simons Town	222
Singapore	75
Sydney	365
Toronto	562
Vera Cruz	198
Wellington	1,266
„ Elec. fuses	30
Yokohama	25
Zanzibar	15
Total	£9,899

Foreign Goods Transhipped.

Gothenburg. Telephones	Value £55
Labrador. Elec. mat.	24
New York. Elec. mat.	90
Otaga. Elec. mat.	25
Total	£194

Colombo. Elec. mat.	Value £15
Durban. Elec. light fittings	23
Total	£38

Electrical Wares Exported.

Week ending July 21st, 1903.

Alexandria	Value £199
Amsterdam	125
Antwerp	341
Bombay	112
Boulogne	13
Brisbane	100
Buenos Ayres	3,165
„ Teleg. mat.	332
„ Teleph. cable	175
Calcutta	1,118
Cape Town	600
Colombo	153
Copenhagen. Elec. cable	1,037
Demerara	90
Durban	1,479
East London	375
Fremantle	245
Gibraltar	27
Halifax	62
Hamburg	17
Hong Kong	25
Lisbon	18
Madras	151
Melbourne	374
Penang. Teleg. mat.	99
Perth	80
Port Elizabeth	380
Rio Janeiro	38
„ Teleg. appar.	2,852
Rosario	46
Singapore. Teleg. mat.	406
Valparaiso	50
Wellington	1,691
Yokohama	600
Total	£16,515

Week ending July 19th, 1904.

Alexandria	Value £32
Amsterdam	324
Auckland	372
„ Teleph. cable	2,273
Bombay	701
Buenos Ayres	308
Calcutta	1,113
„ Teleg. mat.	1,261
Cape Town	160
Christchurch	20
Colombo	154
Delagoa Bay	445
Durban	905
„ Elec. machinery	2,624
„ Teleg. mat.	86
Fremantle	120
Gibraltar	99
Hamburg	84
Hong Kong	27
Kobe	30
Messina	495
Otago. Teleg. mat.	65
„ Teleph. cable	197
Piræus. Teleg. mat.	115
Port Elizabeth	107
Rio Janeiro. Elec. fuse	40
Rockhampton	10
St. Petersburg	550
„ Teleg. cable	85
Santa Cruz	27
Singapore	94
Sydney	584
Tokio	765
Toronto	11
Wellington	552
„ Elec. machinery	341
Yokohama	1,024
Total	£16,140

Foreign Goods Transhipped.

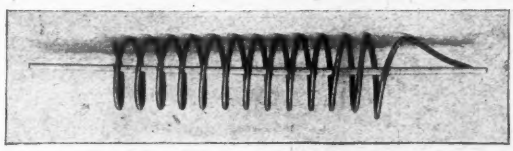
Durban. Elec. goods. Value	£179
Flushing. Elec. appliances	18
Gallegos. Elec. manfs.	46
Otago. Teleg. apparatus	197
Perth. Elec. cable	520
Rio Janeiro. Elec. lamps	28
Total	£988

Cape Colony.—The Customs authorities of the Colony of the Cape of Good Hope have lately given a decision to the effect that "conduits and piping used in connection with electrical fittings" are dutiable at the rate of 15 per cent. *ad valorem*.

Exports of British Electrical Machinery.—The exports of electrical machinery from this country last month amounted to £43,968, bringing up the total for the six months ending with June to £214,854, which contrasts with £224,124 in the corresponding half of 1903.

Air-Brake Equipments.—We are informed that 17 of the Manx Electric Railway Co.'s cars are fitted with Christensen "straight" air-brakes, and that the Newport tramways have six cars equipped with air-brakes on the "straight" system. Messrs. R. W. Blackwell & Co., Ltd., have also been favoured with an order from the Underground Electric Railways Co. of London, Ltd., for over 200 50-cb. ft. motor-driven compressors for the air-brakes on the new trains which are to be operated on the Metropolitan District Railway, and that they are supplying combined vacuum pumps and air compressors which, by the movement of a lever, can be converted instantly from a compressor to a vacuum pump, or *vice versâ*, so that rolling stock equipped with either vacuum or air-brakes can be controlled from the locomotive with a minimum amount of apparatus.

Uralite.—The accompanying illustrations show a coil of wire supported on a strip of uralite. This serves to show the manner in which uralite can be worked with ordinary tools. As was pointed out in our issue of August 22nd, 1902, this material, whilst being a good insulator for ordinary voltages, possesses



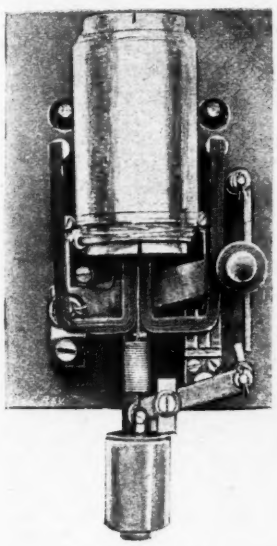
the advantages of being fireproof, mechanically strong, and close-grained; further, it can be worked as easily as wood. Uralite, which is supplied by the British Uralite Co, Ltd., of Cannon Street, E.C., when it becomes better known in the electrical world, will be used for a variety of purposes, where good insulation is required at high temperatures.

Wormwood Scrubbs Prison Lighting.—One of the blocks of Wormwood Scrubbs Prison has recently been installed with electric light by Messrs. R. H. and J. Pearson, Ltd., Notting Hill Gate, W. The block consists of a huge rectangle with a central hall or corridor, opening into which are 352 cells on four floors, the three upper tiers on either side communicating by galleries running entirely round the building. Each cell is lighted by means of an 8-c.p. Robertson lamp fixed horizontally immediately above the door, the lampholder being screwed directly to the conduit, and projecting only 1 in. beyond the face of the wall. Each lamp is controlled by a switch and cut-out fixed outside the door to the right, and is supplied by 7/18 mains running along the under side of the galleries in steel conduit provided with tee joint boxes. These boxes are fitted with porcelain interiors upon which are screw terminals for connecting the branch wires, thus obviating the necessity for making joints. All the tees and elbows used are provided with inspection covers, and the wires can be entirely withdrawn if necessary. At the entrance to the building, immediately inside the door, is fixed the 2-way main switch and fuseboard. This is enclosed in an iron case, glazed in front, and the Thomson meter of the Hammersmith Borough Council is also fixed in this case. From the two sets of terminals are taken two pairs of 19/16 cable, one to each of two 12-way distributing switchboards which are fixed in the centre of the building, facing each other on opposite walls on the ground floor; from these are taken eight circuits to supply the cell lights, and four for lights fixed at intervals around the gallery. The whole installation is erected with Simplex Steel Conduit Co.'s screwed "Wireduct," electrically continuous throughout. Connections are made to earth at various points, and the insulation resistance amounts to ·45 megohms. In the forecourt of the Prison the Council's electricity department has fixed a transformer surmounted by a "Reason" arc lamp; to this transformer, which converts the 2,200 volts of the supply mains to 220 volts for lighting, the Council has laid mains from Wood Lane, considerably over half a mile distant. From the transformer a lead-covered concentric cable has been laid in a wood trough run solid with bitumen, across the forecourt, and is connected to the main board.

Tramcar Collision.—At the Newport (Mon.) County Court on Thursday Mr. Noah Davies, a farmer of Bishton, brought a claim for payment of £50 damages against the Newport Corporation, the action arising out of a collision that occurred between an electric tramcar and a horse attached to a cart and driven by the plaintiff. As a result of the collision the cart was broken and the horse shaken, while the plaintiff had been under the doctor's hands for some weeks. The question being raised as to whether the plaintiff was as near the pavement as possible, Judge Owen observed that many drivers seemed to think that they were entitled to the piece of road the car ran on, but the King's highway was open to everybody. He gave judgement for plaintiff for £35 and costs.

For Sale.—The authorities of the West Riding Asylum, Wakefield, want offers for 56 arc lamps, and 3,275 Conradty carbons. See our advertisement pages this week.

Derby Electric Arc Lighting.—A large portion of the lighting of Derby has been carried out for some years with both alternating current, at 40 cycles per sec., and direct current with the Gilbert 6 ft. carbon lamps, and this has now been considerably extended in both systems in conjunction with the new tramways. Some of the alternating lighting is carried out with parallel transformers with the series circuits of about 15 lamps with Gilbert moving-coil transformers, which differ only in a few details from those used at Eastbourne and other places. The control is only on the primary, the secondary circuit requiring no switches or fuses, and when the current is switched on it at once assumes its predetermined value, at which it remains. The current in these circuits can, however, be varied at will, and can, for instance, be lowered at midnight to say one-half. A special type of automatic cut-out is placed across the leads in the specially designed box clamped on the tramway poles. This is practically a trigger release, short-circuiting cut-out, but is not able to release until the plunger of a small dash pot has gone through its motion, so that the cut-out does not work, and nothing happens unless the voltage is raised



A.C. AUTOMATIC CUT-OUT.

SPRING SUSPENSION FOR ARC LAMPS.

across it for a prolonged period—practically speaking, only when there is something permanently wrong with the lamp circuit. These series circuits are much more steady and free from fluttering than is possible with parallel circuits, easier to control, and less liable to breakdown. The company are at present replacing a rectified lamp circuit with this special system. In addition to the alternating lighting at Derby, there is a considerable amount of new direct-current lighting carried out in series of nine. The lamps are all hung from the trolley wire arms by a special clamp with a spring suspension and a safety catch. The spring in the suspension is made so that its period of vibration is as far removed as possible from the period of the pole and bracket, so that a swing is not set up. Where hoods are used the lamps are suspended with large flat hooks, which is the last thing the Gilbert Arc Lamp Co. have brought out in this direction, so that although the lamps can give, there is no tendency for them continually to swing. There was no room in the pole bases for a convenient arrangement of gear, so boxes were made, of as small dimensions as was reasonable, to contain both the alternating and direct-current gear, making a neater and sounder job than crowding the gear into the confined space in the base of the pole.

Edwards Air-Pumps.—In view of the importance of high vacua in turbine plants, it is interesting to note that Edwards air-pumps have recently been supplied to, amongst a large number of electricity works:—Fulham, Glasgow, Harrogate, Loughborough, Lancashire Electric Power Co., North Metropolitan Tramways, Newcastle and District Co., Poplar, St. Pancras, and Tokio—in each case in connection with steam turbines.

Holidays.—The Robertson Electric Lamps, Ltd., Brook Green Works, will be closed for the annual holidays from Saturday, July 30th, until Monday, August 8th.

Fire Test.—The Metropolitan Asylums Board recently invited a number of gentlemen to witness a practical fire test at Tooting. Two huts of timber framework covered with corrugated iron, lined respectively with felt and pine, and with uralite, were filled with combustibles and ignited; the former was totally destroyed, while the latter was uninjured.

Imports of Telegraph Cables.—The value of the foreign telegraph cables and apparatus connected therewith imported into this country during last month amounted to only £1,672, bringing up the total for the first six months of the year to £16,485, as contrasted with £30,140 in the first half of 1903.

Annual Outings.—On Wednesday, the 13th inst., the staff and employés of the Urban Electric Supply Co., Dartmouth, about 30 in number, had their second annual outing, leaving Dartmouth by the first train in the morning. Torre was reached at 7.15, where char-a-bancs awaited them; proceeding to Newton Abbott, breakfast was served, and, starting from Newton Abbott at 9.15, the drive *viâ* Chudleigh, Egbrook Park, Little Haldon, and Black Forest to Starcross was very much enjoyed. Dinner was served at the Courtney Arms Hotel. After the usual loyal toasts, proposed by Mr. G. E. Smith, the manager, the vice-chairman, Mr. H. C. Babb, on behalf of the whole of the employés, presented Mr. Smith with a very handsome "smokers' cabinet" in solid oak, as a token of the high esteem and respect in which he is held. In responding, Mr. Smith said that the presentation was quite a surprise to him, and he should ever value it as a proof of the goodwill that existed between them all, and that he hoped this good feeling would ever continue. The health of the employés was then proposed by Mr. Smith, and Mr. Hammett proposed, in a few well-chosen words, the firms who had so kindly and so generously subscribed towards the expenses of the outing. The remainder of the time was spent in songs. At three o'clock a start was made for Dawlish. After a walk on the beach for half an hour or so, the party started for Teignmouth, where, after partaking of tea, the members dispersed until seven o'clock, when they left for Torre, which was reached at nine o'clock. There they took train for home, Dartmouth being reached at about ten o'clock.

The employés of Marconi's Wireless Telegraph Co. had their annual outing on Saturday. The men went by brake to Southend, leaving Chelmsford at 6.30 and reaching their destination about 10 o'clock, a most enjoyable ride being experienced. The party assembled for dinner at the Grand Pier Hotel, where a hearty meal was partaken of. In the course of a toast list, Mr. Cave referred to the successful growth of the works under the works manager, Mr. E. Priddle, whose health was toasted with cheers. The party dispersed for the afternoon, and had tea at 4.45, after which a further ramble was indulged in; at 8.30 the trippers commenced the homeward journey, reaching Chelmsford in the small hours of the morning. The female employés went by train to Ipswich, and thence to Harwich by boat, visiting Dovercourt and driving round; they returned to Chelmsford at about ten o'clock.

Catalogues, Lists, &c.—MESSRS. BENJAMIN R. VICKERS AND SONS, of Gascoigne Street, Leeds, send us cards referring to their steam and water packing, engine oil, and their "Octopus" automatic central lubricator, which is claimed to effect a considerable saving in oil.

We have received from MESSRS. ALLEY & MACLELLAN, of Sentinel Works, Polmadie, Glasgow, illustrated catalogues of their "Sentinel" engines, No. 17 E, relating to their high-speed compound and triple types, and No. 18 E, to their Class C (simple non-condensing) type. The catalogues are beautifully got up, and contain, in addition, much information concerning condensers, compressors, pumps, and useful tables.

MESSRS. BUMSTED & CHANDLER, of Cannock Chase Engine Works, Hednesford, send us a card pointing out that, in addition to their well-known single-acting engines, they are now making silent high-speed double-acting engines with forced lubrication, up to 500 B.H.P.

We have received from the BRITISH WESTINGHOUSE Co. their new circular, B 1,070, on polyphase induction motors, types "C" and "C B." The mode of construction is clearly shown in the illustrations, as well as various practical applications to machine driving, with full particulars of dimensions and weights. We have also received the "Westinghouse Diary and Note-book," issued in connection with the Louisiana Purchase Exposition, containing a vast amount of information regarding St. Louis, electrical and mechanical tables and data, coinage systems, machine tools, motors, and the Westinghouse Co.'s publications. The diary portion provides a page of squared paper per diem for the months of June to November inclusive.

The DIESEL ENGINE Co., LTD., of 179, Queen Victoria Street, E.C., send us a circular relating to the Diesel oil engine, for which great fuel economy is claimed, the cost of energy (with crude oil) being given as less than 1d. per B.H.P.-hour for fuel. The engines are supplied for powers from 20 to 1,000 B.H.P., and in the six years since they were introduced more than 800 have been installed, excluding the U.S.A.

THE LANGDON-DAVIES MOTOR Co. send us leaflets describing their spur reduction gear, fitted to their single-phase induction motors, and friction clutches, by means of which the load can be thrown on or off a motor as gradually as may be desired. Prices are given for these apparatus.

From the ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD., Stellite Works, Birmingham, we have received their catalogue B 55, describing the British-made "Stellite" S.D. telephones, for domestic purposes. These short-distance telephones are for use in conjunction with ordinary bell circuits, and are of substantial and handsome construction, while each instrument is guaranteed for 12 months. A switch is provided in the handle, which ensures secrecy when the instrument is not in use, and prevents the battery from running down if the instrument is not hung up when out of use. Full instructions are given for various modes of fixing; double call sets, portable sets, intercommunication sets, Stellite patent electrophones, exchange systems, &c., are also illustrated and described.

MESSRS. ERNEST F. MOY, LTD., of Greenland Place, Camden Town, N.W., have issued Leaflets Nos. 100 and 101, giving dimensions and prices of their single-pole two-way knife switches, type No. 100, for currents from 50 to 1,000 amperes, at 550 volts.

Leaflets E.C. No. 86 and E.C. No. 84 have come to hand from the Electrical Co., Ltd., of 121—125, Charing Cross Road, W.C., respectively giving particulars and prices of their single way quick-break knife switches, up to 400 amperes at 500 volts, one to three poles, and carbons for flame arc lamps.

Mr. Henry Burrell, of 73, Robertson Street, Glasgow, sends us particulars relating to his "Straightback" steamships, which are fitted with electric deck cranes having a radius of delivery of 32 ft. from the ship's side, and capable of discharging each 100 tons of coal or ore per hour.

Messrs. S. Dixon & Son, Ltd., of Leeds Old Brass Works, have issued a circular drawing attention to their "Royal" fire extinguisher, which is of the chemical type.

The British Thomson-Houston Co., Ltd., Rugby, have issued Pamphlet No. 142, and price lists Nos. 82 and 83, dealing with their D.C. and A.C. fan motors and exhaust fans.

Reed's Electrical Engineering and Supply Co., of 128, Southwark Street, S.E., send a card relating to their Edison-Reed glow lamps.

Messrs. E. G. Herbert, Ltd., of Rosamond Street, East Manchester (formerly of Cornbrook Park Works), send us their price list of metal-sawing machines, machine tool accessories, &c., many of them of new design and of great ingenuity.

Messrs. R. W. Blackwell & Co., Ltd., of 59, City Road, E.C., have issued section 12 of their ITE circuit-breaker catalogue No. 59, cancelling sections 3 and 6. This section deals with reverse current circuit-breakers alone, and introduces a design which is operated directly from the generator itself without the use of relays or auxiliary devices, and while it never acts with a forward excess current, never fails to act with a reverse current, no matter how low the line voltage may fall. The principle utilised is applicable to both direct current and alternating current systems, and may be used in conjunction with the ordinary overload release. Full particulars are given of the mode of operation of the "Reversite" type, as it is called, and of its application to generators in parallel, rotary converters, transmission lines in parallel, storage batteries, &c. Leaflets E 18 to E 25, referring to various types of ITE circuit-breakers, are also to hand.

We have also received from Messrs. Blackwell a pamphlet (No. 55) dealing with their Christensen air-brake apparatus, explaining the advantages of the "straight" as compared with the "automatic" system, and describing the details of the Christensen apparatus, with excellent illustrations. Instructions for maintaining the gear in good order and for operating it are included.

Bankruptcy Proceedings.—At Liverpool Bankruptcy Court on Thursday, John James De Lacy and Howard Ryan De Lacy, electrical engineers, of 58, Oldhall Street, Liverpool, were examined. The statement of affairs shows unsecured liabilities amounting to £1,833, and assets estimated to realise £511. The latter sum includes £484 surplus from securities, which, however, are not realisable. John James De Lacy stated that the business was commenced in March, 1900, in partnership with a Mr. Hawkes, who financed it, advancing £635. He retired in May, 1901, and received £500 for his interest; debtor borrowing the money from friends. The examination was adjourned until August 10th.

Notice has been given in the *London Gazette* of 15th inst. that a bankruptcy petition has been presented against Warner & Co., of 12, Holbein Place, Sloane Square, and will be heard on the 28th inst.

The last day for receiving proofs for intended dividends in the case of Thomas Williams, electrical engineer, Cardiff, is 30th inst. Trustee, G. David, 117, St. Mary Street, Cardiff.

The first meeting of creditors in the matter of Messrs. Parkes and Sadleir, electrical engineers, Colwyn Bay, will be held at Bangor on 27th inst., and the public examination on 4th prox.

A dividend will be paid to preferential creditors of the Electric Timber Seasoning and Preservation Co., Ltd., on August 4th.

A first meeting of creditors was held on 19th inst. under the receiving order recently made against Mr. J. L. Higgs, solicitor, Staple-Inn. There being no quorum present, the meeting was adjourned for a week.

Edison & Swan, Reduction of Capital.—A petition for the confirmation of a special resolution reducing the capital of this company, from £1,000,000 to £941,090, is to be heard in the Chancery Division of the High Court of Justice, before Mr. Justice Buckley, on the 26th inst.

Book Notices.—"Gas Works Directory and Statistics" for 1904. London: Hazell, Watson & Viney. Price 10s. 6d. net. This well-known hand-book, which has now reached its 27th issue, needs no commendation. The entries have been revised up to date, and the data under each entry give practically all the information that one is ever likely to require on the subject. Where electric light works are in operation, the name of the supply authority is now given. It is interesting to note that the great majority of gas undertakings, unlike the former, are in the hands of companies, and doubtless it was the success of the gas companies which stimulated the municipal authorities to take electricity supply into their own hands. The book is well printed and bound.

We are in receipt of a copy of the first issue of a new technical journal, *The Motor Boat*. The objects of this journal are to encourage and record the progress made in connection with the manufacture of the marine motor and its application. The first number contains many interesting articles dealing with both racing and pleasure craft, and is well illustrated. *The Motor Boat* is published weekly, price 1d., by the Temple Press, Ltd., Rosebery Avenue, E.C.

"Electric Motors."—We have received from Mr. S. E. Fedden, manager of the Sheffield Electricity Supply Department, a booklet with the above title, intended to further the already flourishing motive power business which his department undertakes. The pamphlet well illustrates the application of polyphase motors to various power purposes, and clearly sets forth their many advantages, which, in the opinion of users (p. 39), more than cover any slight extra cost.

Messrs. Whittaker & Co. will shortly publish "The Telephone Service: Its Past, Present, and Its Future," by Mr. Herbert Laws Webb. This work will be an endeavour to describe in plain language the general features of a modern telephone exchange, and it is hoped that it may be of assistance to the telephone user and others interested in the working and development of the telephone service.

We have received from Messrs. R. Johnson & Nephew, Ltd., of 65, London Wall, E.C., a small hand-book entitled "Wire," which should prove very useful to buyers and users of wires. Tables showing the gauge, weight per mile, diameter, breaking strain, twists and resistance of the various wires in use for telephone purposes are given. Information relating to fencing wires, staples, rope wires for mining purposes, &c., is also contained therein, together with conversion tables from the S.W.G. and various other British measures into the metric system. Messrs. R. Johnson and Nephew are now erecting an addition to their Manchester works of a modern plant for the drawing and tinning of copper wire.

"Report of the Tariff Commission. Vol. I., The Iron and Steel Trades." London: P. S. King & Son. 2s. 6d. net.

Trade Announcements.—Messrs. W. E. Lane and T. D. Curry, of 123, Cannon Street, E.C., announce that they are prepared to undertake secretarial, accountancy, agency, and company work generally; also to act as buyers and London correspondents for merchants, engineers, contractors, shippers, &c., carrying on business in the Colonies and abroad. They have carried on and supervised for some years past the secretarial, clerical, and accounts work for the following companies:—The Electric Lighting and Traction Co., of Australia, Ltd.; The Town and General Estates, Ltd.; and The Manica Copper Development Co., Ltd. Whilst continuing to retain their connection with these companies, they have made arrangements which enable them to undertake additional work of a similar character, utilising for this purpose their present suite of offices. Mr. W. E. Lane, A.M.I.E.E., who is well known to and in close touch with the electrical industry, and technically experienced in the handling of orders for electrical goods, offers his services especially to electrical engineers and contractors in the provinces and abroad who require an agent, buyer, or correspondent in London. They also invite communications from companies, syndicates, &c., requiring office accommodation and the services of a secretary and clerical staff at a moderate expense.

The Asphaltic Limestone Concrete Co., Ltd., of 6 to 11, Commercial Street, Birmingham, finding that untrue reports have been circulated to the effect that it is in liquidation, wishes to emphasise the fact that it was registered as an entirely new and independent company on January 11th, 1904, and purchased from the receiver and manager for the debentures of the old company, bearing the same name, the goodwill and business of that company. The old company has gone into liquidation, and ceased to trade, but the new one, having taken over the works in thorough going order, with the staff of experienced men, is prepared to execute all contracts and work entrusted to it.

Messrs. Edward G. Herbert, Ltd., engineers, of Rosamond Street East, Manchester, announce that, owing to the rapid growth of their business, they have been obliged to move from Cornbrook Park Works to larger works at the above address, to which all communications should be addressed.

Messrs. Rashleigh Phipps and Co. are moving from their present address to larger premises at 147, Oxford Street, to-morrow, and will start business there on Monday next, the 25th inst., when they will have a very artistic selection of electrical fittings on show.

Messrs. Harris, Lee & Co., electrical engineers, of Johannesburg, have removed their London office from 14, Upper Thames Street, to 165, Queen Victoria Street. During Mr. Harris's recent visit Home, they secured the sole agency for the whole of British South Africa for Messrs. Crompton & Co., and amongst other well-known houses whose sole agencies they hold for South Africa are those of St. Helens Cables, Electric and Ordnance Accessories, C. J. Thursfield, Evershed & Vignoles, Gent & Co., Stearn, Gilbert, Bastian, Perfecta Seamless Steel Tube, A.B.P. Accumulator, &c.

Dissolutions and Liquidations. — Notice is given of the release of the liquidator in the case of the Electric Lamp Regenerating Co., Ltd.

The Electrical Machinery Developments Co., Ltd., has passed and confirmed resolutions to voluntarily wind up the company, Mr. F. W. Lowther, of 151, Cannon Street, E.C., being appointed liquidator.

A meeting of the shareholders of Messrs. Braby & Tomlinson, Ltd., will be held at 23, Bucklersbury, E.C., on August 22nd, at 4 p.m., to receive an account of the winding up from the liquidator.

Notice is given in the *London Gazette* of 15th inst. of the dissolution, by mutual consent, of the partnership between Messrs. P. J. Buddery and H. W. Van der Pant, carrying on business as electrical and motor engineers at 5, Kingston Road, Wimbledon, under the style of Percy J. Buddery & Co.

On 19th inst. a compulsory winding-up order was made by Mr. Justice Buckley in the case of Shippey Bros., Ltd.

LIGHTING AND POWER NOTES.

Abingdon.—The local electric lighting company has informed the U.D.C. that it will apply for a prov. order for electric lighting.

Ashton-under-Lyne.—The T.C. has resolved to give users of energy for power the option of being charged on the maximum demand system at 3d. per unit for the first hour's daily use, and 1d. after, or at the present rate of 1½d. per unit.

Audenshaw.—The U.D.C. has taken counsel's opinion as to the liability of the Manchester T.C. to carry out its undertaking to supply the district with electricity. As a result, it has been decided to inform the Corporation that it is advised that the Corporation is legally liable to carry out its undertaking, and to intimate that, unless the mains are laid, proceedings will be instituted against the Corporation.

Beckenham.—The U.D.C. has decided to expend a further sum of £3,000 on free wiring. The E.L. undertaking is leased to a company, and the Council is considering the advisability of extending the lease, as it was admitted that there was a deficit on the working last year of £600. The British Insulated & Helsby Cable Co. has offered to pay 4 per cent. on any sums now raised for free wiring, to cover any charge upon the rates, and to enable the light to be extended in private houses.

Brixham.—The U.D.C. wants offers for the transfer of its electric lighting prov. order. Further particulars are given in our advertisement pages this week.

Burry Port.—The U.D.C. has instructed the Town Clerk to obtain information with a view to introducing E.L. into the town.

Cambridge.—The Electric Supply Co. has reduced the price of energy as under:—Up to 1,000 units yearly from 7d. to 6d. per unit; over 1,000 and up to 2,000, 6d., less 5 per cent. discount; over 2,000 and up to 3,000, 6d, less 7½ per cent.; over 3,000 and up to 5,000, 6d., less 10 per cent.; over 5,000, 6d., less 12½ per cent.

Chertsey.—The U.D.C. has resolved to object to the applications of Edmondson's Electric Corporation, Ltd., and the Southern Electric Corporation, for prov. orders for electric lighting.

Clewer Without.—The Windsor Electrical Installation Co. having notified its intention to apply for a prov. order for electric lighting, the P.C. has decided to assent to the application.

Croydon.—The Lighting and Electricity Committee recently presented its report to the T.C. Upon the advice of its electrical engineer, the Committee recommended that mains extensions at a cost of £373 be carried out, partly to supply the workshops of the L.B. & S.C. Railway, and that during the period of light load, *i.e.*, 11 p.m. until dusk, the charge for energy for power purposes be 1½d. per unit. During the time between dusk and 11 p.m., consumers should have the option of paying 5d. per unit, or having the supply cut off by a time-switch, excepting on Wednesdays and Sundays, when the demand for electric light is small, and the switches would be so arranged that the higher rate would not be charged. The rental to be charged for these switches to be from 5 H.P. at £2 per annum to 20 H.P., or above at £4 per annum.

The borough electrical engineer's report on the seventh year's working of the undertaking shows a net profit, after providing for sinking fund and interest, of £6,754, an increase of £2,099 on the previous year. The capital expenditure during the year was £36,843, bringing the total up to £271,258. The total expenditure amounted to £25 538, as compared with £21,889 in the last year, and the total receipts were £46,596, as against £40,157, leaving a gross profit, deducting £58 carried forward, of £21,000 as against £18,200. Interest and sinking fund charges, &c., amounted to £14,246. The number of consumers increased during the year from 96,479 to 115,461; the number of units sold during the year amounted to 3,633,248, as against 3,131,841 in the previous year—a 16-per cent. increase; the percentage of increase in supply being, for traction, 12·5 per cent., private supply, 26·1 per cent., public lighting, 4·1 per cent. The total length of mains now laid in the borough amounts to 162 miles, 12 miles being laid during the last financial year. Out of a net revenue balance of £8,347, £5,000 has been appropriated to the reserve fund, and the balance carried forward. The reserve fund now stands at £12,500. A scheme is being prepared by the electrical engineer for the hiring out of motors. The report was adopted.

A loan of £27,000 for mains extensions has been applied for by the Council.

Devonport (Tasmania).—The system laid down for the electric lighting of this town is the three-wire D.C., with accumulators. The street lighting is effected by means of 10 arc lamps, suspended over the centre of the main street, and by 39 incandescent lamps. The original scheme provided for an installation equivalent to 2,800 8-C.P. lamps in the town. The plant has been in operation five months, and the equivalent of 3,000 lamps are at present connected, while 1,000 lights and the motive power for two factories are on order. The generating plant consists of one 50-H.P. "Eclipse" boiler, and a Belliss 50-H.P. engine, coupled direct to a 32-KW. generator. The switchboard contains six panels. A pair of balancers are provided, and two boosters for charging the accumulators. The steam generator, switchgear, lightning arresters, &c., were supplied and erected by the Brush Electrical Engineering Co., under the supervision of Mr. A. H. Warden. The storage battery consists of 240 "Tudor" cells. The cost of the scheme was about £8,000. The prices charged for energy are 8d. per unit, with a rebate for any quantity consumed above two units per lamp per month, for lighting, and 4d. per unit for power. The scheme, which is under the control of a local town board, was designed by Mr. William Corin, consulting engineer to the Launceston City Council, and the board has since appointed Mr. George W. Lofts as the town electrical engineer. Owing to the large demand for electricity, Mr. Lofts has prepared a scheme of extension, which practically involves a duplication of the present plant, and the laying of 10 miles of additional street mains. This scheme has been approved by the board, and the ratepayers have just sanctioned the borrowing of £4,000 to carry it out.—*The Australian Mining Standard.*

Dover.—The T.C. is applying to the B. of T. for a prov. order enabling the Corporation to supply energy within the area of the R.D.C.

Dundee.—The T.C., on the 15th inst., considered a proposal made on behalf of a firm of electrical engineers in London, to float a company, with a capital of a quarter of a million, for the purpose of supplying electric power to mill-owners and manufacturers in the city. The promoters undertook to supply power at a minimum of ¾d. per unit, and a maximum of 1½d. per unit, and not to interfere with the city's present method of supply. The Council's electrical engineer advised that the scheme be not entertained, on the ground that when their new power station was erected the city would be able, with their present plant, to supply power on better terms than a private company. The Council decided not to entertain the proposal.

Egham.—The Urban Electric Supply Co. having given notice of its intention to apply for a prov. order for electric lighting, the R.D.C. has decided to seek the opinion of the Surrey C.C. on the matter.

Egypt.—A Cairo contemporary states that an English syndicate has made an application to the Ministry of Public Works for a concession to light by electricity the towns of Damanhour, Luxar, and Assuan. "There is very little probability of the application being entertained," (says our contemporary), "as the Government, in view of the unsatisfactory results obtained from electric lighting concessions granted for Mansourah, Helouan, and other localities, have decided upon refusing any other application of this nature."

Germany.—The Lahmeyer Company of Frankfort-on-Main, has secured a contract from the municipal authorities of Sorau, for the establishment of an electric lighting station in the town.

Gillingham.—The T.C. has applied for sanction to borrow a further sum of £20,000 for electric light purposes, and is negotiating with the Admiralty with regard to lighting the Naval Hospital.

Gravesend.—The Council is to offer £250 to the Northfleet U.D.C. for its consent to the extension of the Gravesend E.L. order so as to include Northfleet.

Hapton.—The P.C. has decided to have the parish lit by electricity.

Harpenden.—The Mutual Electrical Supply Co. is seeking a prov. order for supplying electrical energy to the district.

Ince.—The U.D.C. has applied for a further extension of its prov. order for electric lighting.

Italy.—Application has been made to the Prefectural authorities of Como for a concession to put down a plant to utilise the water-power of the River Ponzate for electric lighting and power purposes at Ponzate.

King's Lynn.—The accounts of the Corporation electricity department for the year ended March 31st last, in brief, are as follows:—

	1904.	1903.
Revenue, private lighting and power	£3,295	£2,639
" public lighting, including maintenance	1,992	1,981
Total, including meter rents, &c. ..	£5,686	£5,054
Total works costs, including public lighting ..	2,330	2,189
Interest	1,286	1,339
Sinking fund	1,580	1,580
Sundries	3	—
Profit balance on year's working ..	£487	Deficit £47
Total works cost per unit, including public lighting	1·449	1·626
Average price obtained for all kinds of supply per unit	3·13	3·27

The total number of units sold amounted to 388,472; the number of consumers connected was 459; the total connections in equivalent 8 C.P. lamps, including public lighting, amounted to 21,119; and the maximum load during the year was 290 KW. We are pleased to note the satisfactory outcome of the past year's working, resulting in a profit of £487, against a deficit in the previous year of £47. The electrical engineer is Mr. John Pilling.

Kuala Lumpur.—The estimated cost of the electric lighting installation in this town in the F.M.S. of Selangor, is $815,500.

Lytham.—Messrs. Foote, Milne & Co. have informed the U.D.C. that they intend to apply to the B. of T. for a prov. order for E.L. The Industrial Engineering Co. is making a similar application.

London.—L.C.C.—At the meeting on Tuesday it was decided to sanction the borrowing by the Islington B.C. of £15,636 for electric lighting purposes, and to advance £25,000 to the Poplar B.C. for similar works.

ST. PANCRAS.—The following reductions in the charges for energy have been sanctioned by the B.C., and will come into operation forthwith :—For lighting purposes to consumers using the maximum demand system, from 6d. per unit the first hour and 3d. afterwards to 6d. per unit the first hour and 1½d. after; the present flat rate of 5d. per unit to be reduced to 4d. For power, the present rate of 2d. per unit to be reduced to 1d. per unit. The above charges are to apply only to consumers who are supplied at the pressure of 220 volts or 440 volts, and also to consumers who agree to change from the 110-volt pressure of supply to the higher voltage when required by the Council. The foregoing charges are not to apply in the case of the supply to Messrs. Price & Reeves, the contractors for the construction of the Charing Cross, Euston and Hampstead Railway, until such time as they have taken 1,000,000 units.

The Electricity Committee reported having had under consideration the basis of charge for the lighting of the public street lamps. The L.G.B. auditor has made a request that £4,311, being outlay on arc lamps and columns, included in the electricity undertaking capital account, shall be transferred to the general fund account, and that fund shall take over the liability on capital account, and also in future shall pay for the cost of maintenance (*i.e.*, labour, trimming, repairs and carbons) as a separate charge, and that the charge for energy to the public street lamps shall be distinct from any other charge. The Committee agreed, and, in consideration of the general fund taking over the liability on capital account, and the cost of labour, trimming, repairs, carbons, &c., it was agreed that the charge for street lamps should be reduced from 3d. to 1½d. per unit.

The Committee was authorised to enter into negotiations with firms which let out motors on the hire-purchase system.

MARYLEBONE.—The Finance Committee reported to the Borough Council on Wednesday last week that the taxed costs of the Council in relation to the arbitration proceedings were £27,349 9s. 10d. The Electric Lighting Committee reported that, having fully considered the question of the alleged defective title of the Metropolitan Electric Supply Co. to the property known as South Mews, which the Council was required to purchase under the Electric Lighting Order Confirmed (No. 1) Act, 1901, it could not withdraw its objection to the title, and was of opinion that the municipality would be entitled to compensation if the defects were properly explained to the Court.

WESTMINSTER.—The City Council has refused to support the Borough Council in seeking powers to wire the premises of consumers taking a supply of energy.

BERMONDSEY.—In view of the large demand for energy by the Dock Co., and on the recommendation of its electrical engineer, the B.C. has decided to lay down another main to the Dock Co.'s premises at an estimated cost of £3,082.

SHOREDITCH.—The B.C., on the recommendation of its electrical engineer, has adopted the following sliding scale of charges to large consumers using energy for power purposes:—Not less than 50,000 units per annum, 25 per cent. off 2d. rate; 35,000 units 20 per cent., 25,000 units 15 per cent., 15,000 units 10 per cent., 10,000 units 5 per cent., 5,000 units 2½ per cent. Consumers using not less than 50,000 units per annum for power purposes are to be charged a flat rate of 3½d. per unit for lighting. These charges are to come into force from the commencement of the next December quarter. A revision of the charges for lighting is under consideration. L.C.C. loans of £7,000 for the Haggerston electricity extension, and of £9,958 in respect of the Hoxton lighting station have been taken up.

It is proposed by the Lighting Committee of the B.C. to hold an electrical exhibition at the Pitfield Street Baths in October next, from the 10th to the 22nd. Forms of application for space should be sent to the electrical engineer not later than the 15th prox.

HACKNEY.—In consequence of opinions obtained from Messrs. W. R. Bousfield, K.C., and J. Fletcher Moulton, K.C., upon the contention of Mr. Robert Hammond that his engagement as consulting electrical engineer to the B.C. is for all future extensions, the Joint Finance and Electric Lighting Committee has decided (subject to the usual confirmation) that no further supplemental agreement be made with Mr. Hammond.

Margate.—The T.C. has received notice that the Margate Electric Supply Co. intends applying for E.L. powers.

Marlborough.—The local Electric Light Supply Co. has informed the T.C. that it intends applying for a prov. order for electric light, but the Corporation has decided to seek the right to supply energy itself.

Mynyddislwyn.—The U.D.C. has decided to seek expert advice as to the desirability of lighting the district with electricity.

Oakengates.—The Shropshire and Worcestershire Electric Power Co. has informed the Council that it intends applying for a prov. order for E.L.

Oldham.—The Oldham Corporation Electricity Committee presented at the meeting last week, an analysis of the accounts of the department for the year ended March 25th, 1904. It showed the financial result to be a net loss of £771, against a profit of £5,329 on the preceding year's working. The Committee had reduced the charge for energy on tramway account, which is held to be responsible, in part, for the adverse balance. The chairman of the Committee stated that the result was very satisfactory, considering that it had had to build a large supply station, which was not yet ready for that purpose. The lighting department had an increase in income of £800 12s. The number of units sold for traction purposes was 2,177,309, and the revenue amounted to £13,608, as compared with 2,090,127 units and £14,741 revenue last year, being an increase of 87,182 units and a decrease of £1,133 revenue; so that it had made a loss of £1,133 by the reduction made to the Tramways Committee, to which had to be added 87,182 units which the Committee had given more than it had given before for the same money. Practically the concession made to the Tramways Committee had cost about £1,673, and a loss of only £771 3s. 6d. resulted on the year's working.

Nelson.—Below we give the chief items from the accounts of the Corporation electricity department for the past year's working, ended March 31st last:—

	1904.	1903.
Total revenue, including rents	£5,998	£3,685
Sundry receipts	629	696
Total	£6,627	£4,381
Total works costs	2,726	2,055
Interest	1,923	1,481
Sinking fund	1,577	1,362
Profit balance on year's working transferred to depreciation account	401	Deficit 517
Total works cost per unit	1·176	1·539
Average price obtained per unit	2·509	2·76

The total number of units sold was 555,876, and the total equivalent 8-C.P. lamps connected amounted to about 21,588, with a maximum load recorded of 594 KW. The borough electrical engineer is Mr. W. A. Fraser.

The T.C. has offered to supply electricity to works in the town for power at 2d. per unit with discount, on the undertaking to use not less than 80 per cent. of the total horse-power installed for nine hours per day.

Penge.—The Blackheath and Greenwich District Electric Light Co. has fixed the price per unit over the greater portion of the district at 4½d. for private lighting, and 3d. for the street lamps.

Portslade.—The Mutual Electricity Supply Co. and the Hove and District Electric Supply Co. have notified the U.D.C. that they each intend to apply for a prov. order for electric light supply in the district. It is suggested that the U.D.C. should apply for an order itself and sub-let it to a company, or purchase energy in bulk from the Brighton Corporation.

Ramsbottom.—The U.D.C. has asked the B. of T. to allow a further extension of time in which to carry out the work included in the E.L. order, which expires on July 27th. The Council has taken this step owing to the financial position of the district.

Redditch.—The U.D.C. has decided to apply to the L.G.B. for a further loan of £7,500 for the provision of additional steam plant at the electricity works.

Runcorn.—Mr. G. Vaughan Fowler (Warwick) has informed the U.D.C. that he intends applying for a prov. order for E.L., and the Council has referred the matter to the Mersey Electric Supply Co., to whom it is proposed to transfer the Council's order. Owing to pending negotiations, the B. of T. has deferred consideration of the revocation of the order for six months.

St. Albans.—The local Electric Supply Co. is seeking powers to supply electricity within the area of the R.D.C.

St. Anne's.—The U.D.C. has resolved to appeal against the assessment of the electricity works, which has been increased from £350 to £1,000, meaning an increase of ·11d. per unit on the output.

Simla.—The Punjaub Government has appointed Mr. J. W. Meares, of Calcutta, as electrical expert on the committee that has been formed to consider Major-General Beresford Lovett's scheme for extending the water supply of the district in combination with a scheme for lighting the town by electricity.—*Indian Engineering.*

Spennymoor.—The U.D.C. has accepted the tender of the Northern Counties Electricity Supply Co. for public lighting at £2 7s. 6d. per lamp per annum. The Gas Co. tendered at £3 4s. 6d. per lamp.

Swindon.—In a report to the T.C. the electrical engineer details the extensions to the generating station proposed by him to provide for the winter after next. The estimated cost is £6,000.

Swinton and Pendlebury.—Two companies have informed the U.D.C. that they intend applying for prov. orders for E.L. The Council possesses an order, but has taken no steps to carry it out.

Sydney (N.S.W.).—The work of installing the electrical plant for the lighting of Sydney is being carried on rapidly. Recently as much as 9½ miles of cable were laid by Messrs. W. T. Henley's staff, and the whole work of covering and restoring the pathway completed, in five days. During the continuous wet weather which had been experienced, and owing to the narrow streets and pathways, a good deal of inconvenience was caused to business people in different parts of the city by the extensive disturbance of the footways, but the City Council officers expressed themselves as thoroughly satisfied with the efforts of the company to vigorously execute their contract.

Thames Valley.—The Twickenham and Teddington Electric Supply Co. has laid mains in 12 roads in the Hampton district.

The Mutual Electricity Co. is to apply for a prov. order for electric lighting at Thames Ditton. The Council has intimated that Edmundson's Electricity Corporation will probably obtain an order shortly with the Council's consent.

Tring.—The Empire E.L. and Power Co. has informed the U.D.C. that it intends applying to the B. of T. for a prov. order for electric lighting.

Walsall.—The price of energy supplied to the tramways has been reduced to 2d. per unit up to June 30th, and to 1½d. per unit after that date.

Westhoughton.—The U.D.C. has decided that it is advisable to take immediate steps to formulate a scheme for putting into operation the powers of its E.L. prov. order. Offers to carry out the order made by three companies are being considered.

Yeovil.—The T.C. has resolved not to lease its prov. order for E.L.

TRAMWAY AND RAILWAY NOTES.

The Board of Trade and Tramway Problems.—Sir Herbert Jekyll, Assistant Secretary to the B. of T., recently received a deputation from the Roads Improvement Association. Mr. Worby Beaumont suggested that the Board should no longer sanction the erection of posts along the middle of roads. Such standards were not necessary, and they enormously reduced the usefulness of the thoroughfares and hindered the maintenance of the pavement in a uniform condition. Colonel Crompton urged the adoption of recommendation 50, of the departmental committee appointed last year: namely, that except in very special cases no tramway or light railway should in future be laid on any road which had not a minimum width of 33 ft., if a double line was contemplated, or of 27 ft. if a single line was to be constructed. Mr. Rees Jeffreys, hon. secretary of the Association, argued in favour of a central authority specially charged with the duty of protecting the rights of general vehicular traffic. Mr. Howard Humphreys, referring to the growing importance of heavy motor traffic, pleaded that railway and canal companies should be compelled to keep their highway-bearing bridges up to the original strength, and should not be allowed to close them wholesale against self-propelled vehicles, as was being done in Staffordshire and Monmouthshire. Mr. Robert Todd, chairman of the Association, Mr. R. Noble, and Mr. R. J. Smith, also took part in the proceedings. Sir Herbert Jekyll promised to lay the representations of the deputation before the Board.

Buenos Ayres.—The City of Buenos Ayres Tramways Co. has appointed Messrs. Kincaid, Waller, Manville & Dawson to represent it during the electrification of its systems.

The report of the Cia. Alemana Transatlántica de Electricidad for 1903 shows that for tramway purposes 5,000 I.H.P. was employed, supplying energy to 355 cars on the Anglo-Argentine, Buenos Ayres and Belgrano, and Buenos Ayres Electric Tramways. Referring to the company's metropolitan tramway, the report states that reconstruction for electric traction is now nearly complete.

The public works department of the municipality has reported unfavourably on the petition sent to congress by Messrs. Lacroze and Co. for permission to electrify their route, on the ground of unfairness to other companies.

Bury.—The Bury section of the Manchester, Bury, Rochdale, and Oldham Tramways recently passed into the hands of the Bury Corporation, with a view to their electrification. This work is being pushed forward rapidly, and as the last section—that to Tottington—was taken in hand on Monday, July 11th, the steam car service was finally withdrawn.

Burton-on-Trent.—On the occasion of Messrs. Bass and Co.'s trip on the 15th inst., the Corporation Tramways department made the concession of carrying the trippers to and from the railway station for a universal 1d. fare. Some 5,400 people were carried, and the receipts amounted to £22. Owing to the frequency of the brewers' trips, special cars are run nearly every week during the summer.

Falkirk.—At the monthly meeting of the T.C., the Tramways Committee submitted a draft agreement which had been drawn up in connection with the running of Sunday cars by the Falkirk and District Electric Tramways Co. The conditions stipulate that in the event of the T.C. acquiring the tramways undertaking, it shall be entitled to do so on the basis of a six days' running only—that is to say, Sunday earnings are not to be included in fixing the price to be paid. For this purpose the company is to keep separate books showing the earnings and expenses connected with a six days' week, and the earnings and expenses of Sunday running. The cars are not to be run on Sundays between the hours of 11.30 a.m. and 12.30 p.m., and 2.15 p.m. and 3.15 p.m., no more than the week-day fares to be charged on Sunday. The conditions also stipulate that the tramway employés are to be employed six days in the week, each employé to be allowed one Sunday off in every three Sundays. In the event of the company at any time contravening the terms of the agreement as to Sunday running, the T.C. reserves the right, without legal proceedings, to terminate the agreement, and to call upon the company to stop Sunday running. The draft agreement was adopted, and has been forwarded to the company for approval.

Huddersfield.—On Monday last the trolley pole of a Sheepbridge car left the wire near Hebble Bridge, Bradford Road. The car proceeding forward, wrenched one of the posts from its position and lowered the trolley and guard wires attached to it. There were many passengers on the top of the car, but no personal injury was sustained.

The borough treasurer's financial statement for the past three months shows that the capital outlay on the tramways to date is £412,702. The miles run were 420,954, compared with 409,825 in the same period last year. The receipts amounted to £17,417, or 9·93d. per car-mile, as against 9·81d. The total working expenditure is £8,940, equal to 5·09d. per car-mile, as against 5·32d. The gross surplus is £8,476 10s. 2d. Applying £3,410 to interest on debt, and £2,660 to the redemption of debt, there is a net surplus of £2,406, or 1·38d. per car-mile, compared with ·70d. last year.

The town clerk of Brighouse has written to the Corporation asking it to definitely abandon all claims to the construction of the tramways to Brighouse.

Littleborough.—The U.D.C. has petitioned the B. of T. for an extension of time in connection with the tramways prov. order.

London.—L.C.C.—Representatives from all the Borough Councils north of the Thames were present at a conference convened by the L.C.C. to consider matters concerning the electrification of the northern tramways. It was announced that a compromise had been come to between the authorities at Spring Gardens and the North Metropolitan Tramways Co., by which about one-third of the lines would be electrified on the conduit system, and the remaining two-thirds on the trolley system. Strong objection was raised by the delegates, but they were told, on behalf of the L.C.C., that the company opposed the introduction of the conduit system on the lines leased by them on account of the cost. Failing to accept the compromise, the electrification would have to be delayed until the lease expired, in 1910. The conference was adjourned in order that the councillors might explain the situation to the B.C.'s, and that the L.C.C. might report in detail as to the cost of the different systems and the reasons which caused it to accept the compromise. Several delegates pointed out that, under Sec. 23 of the Electrical Powers Act, 1900, the overhead system could not be installed without the Borough Councils' consent. They stated that they would urge their Councils to withhold this consent.

It is stated that the County Council's underground tramway between the Strand and Holborn will not be completed before the end of 1905. The subway is to hold single-deck cars, but the tramway work is as yet untouched. Below the western end of Aldwych, the subway is nearly completed. At the junction of Aldwych and Kingsway a station is to be constructed. Going northward there will be Great Queen Street station, which is to have an island platform with staircases at each end. Here the ground is opened for convenience in working. Underneath Holborn the subway dips, from 16 ft. below the street to 32 ft., a change of level necessitated by a sewer. At this point the tunnel has been constructed with Greathead shields, so as to avoid disturbing the traffic overhead. The subway is here over the Twopenny Tube and the Great Northern and Piccadilly Railway, which is to have a station 100 ft. below the surface at the corner of Kingsway and Holborn. Immediately after reaching Southampton Row, the tramway will rise to the surface in that street by an incline of 1 in 10. The length of the tramway from Theobald's Road to the Thames Embankment will be slightly over ¾ mile.

The Highways Committee last Tuesday reported having had under consideration the question of the steps to be taken with a view to the conversion to electric traction of further portions of the southern tramways and for the construction of new lines. A definite conclusion as to the system to be adopted had not yet been arrived at, but whether it was decided to install the conduit or the overhead system, it would be necessary to provide the same generating plant, machinery, carsheds, and sub-stations. The Council adopted a recommendation of the Committee proposing an expenditure of £1,250 for the preparation of plans in connection with the erection of car-sheds and sub-stations.

The Highways Committee presented a further report in reference to the power station now being erected at Greenwich, and expected to be completed early in 1906. It would be necessary to establish an additional sub-station at Greenwich, and the Committee recommended the Council to sanction an expenditure of £33,500 for the erection of the building and the provision of the plant. The consideration of the proposal was adjourned for a week.

An expenditure of £3,000 was approved for the purchase of additional tools for the use of motormen, conduit cleaners, breakdown gangs, &c.

On the notice paper to be considered at a recent meeting of the County Council the following motion stood:—"That it be referred to the Highways Committee to consider and report upon the practicability of granting free passes on the Council's trams to parties of

children from the Council's schools in poor districts taken by responsible teachers to the Council's parks and open spaces."

A car with a top-deck cover is running on the Peckham line, and an order has been placed for 60 additional cars of the same pattern.

Mr. J. Allen Baker, chairman of the Highways Committee, replying to a question recently, stated that in order to realise the tramway estimates for the present financial year a sum of £66,781 more than the receipts of last year was required, and of this £32,107 had already been realised.

NORTH LONDON.—On Tuesday last, Major J. W. Pringle, R.E., and Mr. A. F. Trotter made an official inspection, on behalf of the B. of T., of the tramways from Finsbury Park to Wood Green and Seven Sisters Corner, Tottenham, reconstructed for electric traction on the overhead system by the Metropolitan Electric Tramways, Ltd. Satisfaction was expressed regarding the manner in which the work had been carried out, and these important sections will therefore be opened for public traffic immediately on receipt of the B. of T. certificate. They form the first part of an extensive system, with a total length of about 50 miles of electric tramways and light railways, in North London. We understand that the first result of the change from horse to electric traction will be a reduction from 1½d. to 1d. in the fare from Finsbury Park to Wood Green terminus.

An inspection by the Press of the reconstructed tramways of the Metropolitan Electric Tramways, Ltd., and of the Brimsdown main power station, will take place to-day.

Llandudno and Colwyn Bay.—A B. of T. inquiry was held on Friday, into the application of the Llandudno and Colwyn Bay Electric Railway Co., for an extension of time for constructing the electric tramway. There was some opposition, on the ground that no substantial progress had been made with the work, and it was pointed out that the Llandudno Council had laid down plant for supplying the current, at a cost of £3,243, entailing an annual charge of £203.

Maidstone.—Having received the Board of Trade certificate, the Corporation's tramways were inaugurated on the 15th inst. The system has been constructed under the superintendence of Mr. E. E. Hoadley, borough electrical engineer, who has also been appointed general manager for the tramways. The contract for the work was given to Messrs. Dick, Kerr & Co., whose price for constructing the line, overhead equipment, and supplying the cars, was £18,000; while the total cost to the town will be £23,000. The cars are of the double-deck single-truck type, and provide accommodation for 26 passengers outside, and 22 in; they were made for Messrs. Dick, Kerr & Co., by the English Electrical Manufacturing Co., Ltd., Preston, and are fitted with the Hudson & Bowring trigger lifeguard and folding steps. The electrical equipment consists of two 25-H.P. Dick, Kerr motors, and slipper, rheostatic, and hand brakes are fitted. The length of the present route is two miles. The Chatham and District Light Railways Co., Ltd., have obtained powers to construct a tramway from Chatham to Maidstone about eight miles.

Manchester.—The Corporation some months ago, on the recommendation of the Tramways Committee, adopted certain bye-laws prescribing the distance at which the driver of a carriage, using any tramway, should follow another carriage. The proposed distance was one of not less than 15 yards, but some exceptions were suggested, these including the business parts of the city, where it was proposed the distance should not be less than 2 yards, and that when it was less than 15 yards the driver should "proceed slowly." These bye-laws did not commend themselves to the National Carriage and Horse Owners' Accident Insurance Union and the Horse Owners' Union, and the latter appealed to the B. of T. It is now announced that the B. of T. has disallowed the bye-laws.

Mexico.—A company is reported to be in formation with the view of establishing a system of electric tramways in the district of Parral, in the State of Chihuahua.

Morecambe.—Negotiations are in progress for electrifying the horse traction line of the Morecambe Tramways Co., and at the meeting of the Corporation on Monday resolutions were passed by the T.C. with a view to furthering the scheme. The line in question extends along the promenade from Bare to Heysham, a distance of four miles.

New York.—The firm of which Sir Weetman Pearson is the head, has been incorporated under the laws of the State of New York with a capital of $1,000,000. This has been done in order to secure a legal status to carry out the contract for the Pennsylvania Railroad tunnel, through which electric trains will run from the mainland into New York City.

New York City.—The underground subway cars will commence running on September 1st. The section to be opened has been constructed at a total cost to date of $37,750,000, the money having been advanced by the city, and the contractor, Mr. John Macdonald, having to construct and maintain it for 50 years, after which it becomes the property of the municipality.

Rochdale and Oldham.—The arbitrator who acted in connection with the acquisition of the undertaking of the Rochdale and Oldham Tramways Co. by the Bury, Rochdale, and Oldham Councils, has fixed the purchase price at £159,075. The company asked £205,401, and the Councils offered £123,784.

Royton and Crompton.—A loan of £54,330 for the construction of the new electric tramways has been applied for by the U.D.C's.

Southport.—The summary of the accounts of the Corporation electric tramways for the year ended March 31st last, shows that the capital expended 1903-4 was £118,364; traffic revenue, £17,304; against £16,179 in the previous year; gross profit, £6,660; against £5,155. The financial result, after providing for interest, lease rentals and sinking fund, leaves a deficit of £341. The length in miles of the single track is 10·77; the passengers carried during the year being 3,837,206, against 3,535,434; number of passengers per car-mile, 8·90; traffic revenue per car-mile, 6·12d.; Board of Trade units used, 492,261; units per car-mile, 1·14. Cost of energy purchased from electric supply department, £3,077; against £3,155; total operating costs, £12,986; against £11,232 in the previous year.

Swinton and Pendlebury.—The Swinton and Pendlebury District Council is asking the B. of T. to sanction a loan in respect of the interest on the purchase price of the tramway undertaking in their district. The Salford Corporation, which is working the lines, under arrangement with the District Council, is responsible for the repayment of the loan.

TELEGRAPH AND TELEPHONE NOTES.

German-Dutch Cable in the Far East.—The company called the German-Dutch Telegraph Co. has been formed with a capital of 7,000,000 marks, to lay and work a cable from the Dutch Settlements in the Celebes to the island of Yap, in the Pelew Archipelago, and thence to Shanghai and the island of Guam, where it will connect with the Pacific cable of the Commercial Cable Co. The company will receive an annual subsidy of 1,900,000 marks from the Dutch and German Governments. The sum of 14,500,000 marks required for the laying of the cable will be provided for by the issue of bonds.

A Long Private Telephone Line.—According to the *Daily Express* the Vanderbilts have given out a contract for the construction of a private telephone line from New York to Chicago, a distance of nearly 1,500 miles.

Manchester.—The success of the Holborn telephone girls in their strike against the National Telephone Co. is having its effect elsewhere on the system. At the Manchester Central Office, where the girls consider themselves to be suffering under several disabilities, a number of the senior operators have discussed their grievances, and have agreed upon a united petition to the company for the maximum wage to be raised to £1, and other concessions.

New York.—So far, 663 street police telephone boxes have been put up in Manhattan by the New York Telephone Co., and these having proved successful, the whole of the Greater City is to be covered in a few months' time, providing for a perfect system of intercommunication from any call box to any police station. The police call box system has been successfully operated in Brooklyn since 1880. Call boxes are also to be placed in certain hotels, and in addition responsible citizens will be allowed to have pass keys for the street boxes.

Oriental Telegraphic Methods.—The *Financial News* quotes Mr. G. B. Howard to the effect that "A word as to violation of trust on the part of the Chinese Imperial Telegraph Administration would not come amiss. The fact that a copy of any message sent over this line can be obtained for a few dollars is certainly hardly credible to Western ears, accustomed as we are to regard anything confided to the wire as being strictly confidential as the secrets of the confessional. But it is nevertheless the fact all through China and in all offices possessing Chinese clerks and operators. I have been offered copies of State messages by a Chinese operator in Peking."

Portsmouth.—The recently issued return of the Corporation's Telephone Department shows that the capital expended amounts to £29,100, as against £19,860 in 1903. The working expenditure amounted to £3,890, inclusive of £588 fees to the Postmaster-General, and the revenue to £6,571, leaving a balance of £2,680, which is increased by items of interest, &c., to a total of £2,698. Financial charges (interest and sinking fund) absorb £1,464, and the surplus, £1,234, was carried forward.

We gather that the number of telephones working at March 31st, 1904, exclusive of junction lines was 1,659, the number of subscribers lines was 1,384; extension and other lines, 293; exchanges, 6; underground cables, 8; underground cables distributors, 68; the mileage of metallic circuit wire, overhead, was 566¼ miles, and underground, 1,224 miles; while the employés number 66—a decrease of four compared with the previous year.

(*Continued on page* 143.)

THE NEEPSEND POWER STATION OF THE SHEFFIELD ELECTRICITY DEPARTMENT.

(*Concluded from page* 103.)

Turning to the engine room, two of Messrs. C. A. Parsons' 1,500-kw. turbo-alternators each provided with a direct-coupled exciter, are at present installed.

The turbines are arranged for running condensing at a speed of 1,500 r.p.m., with a working steam pressure of 190 lbs. per sq. in. at the stop valve, and about 150° F. of superheat.

Mechanical governors are fitted for regulating the speed, but safety governors are also provided for entirely cutting off the steam supply in the event of accident.

The turbines are direct coupled, through flexible couplings to two-phase alternators, and the exciters are mounted on an extension of the bed-plates beyond them.

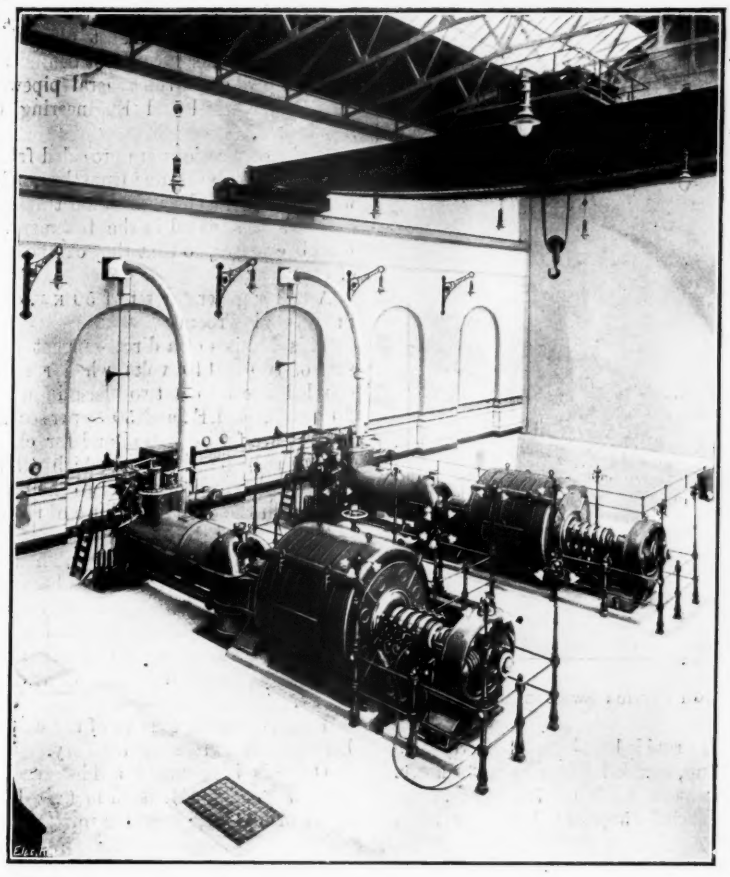


Fig. 9.—View of Engine Room from Switch Gallery.

The alternators are constructed with four radially fixed magnets of circular pattern, the coils being mounted on laminated pole-pieces. The armatures, which are of the revolving pattern, are "tunnel" wound. These machines give a voltage of 2,100 to 2,200, with a frequency of 50 ~ per second.

The exciters work with an E.M.F. of about 85 volts, and the energy used in the excitation of the alternator fields proved on test to amount to about half of 1 per cent.

The development which has taken place in turbine construction, is well seen when the turbine-set brought over from the Paris Exhibition, and installed at Sheaf Street, is compared with the plant recently added at Neepsend.

The condensing plant in connection with the turbines is situated in the basement, as also are the oil coolers, through which the lubricating oil for the turbines is passed.

The water for use in the coolers is obtained from the condenser-circulating supply, but for use as an alternative, a further supply is provided by means of a connection to the town mains.

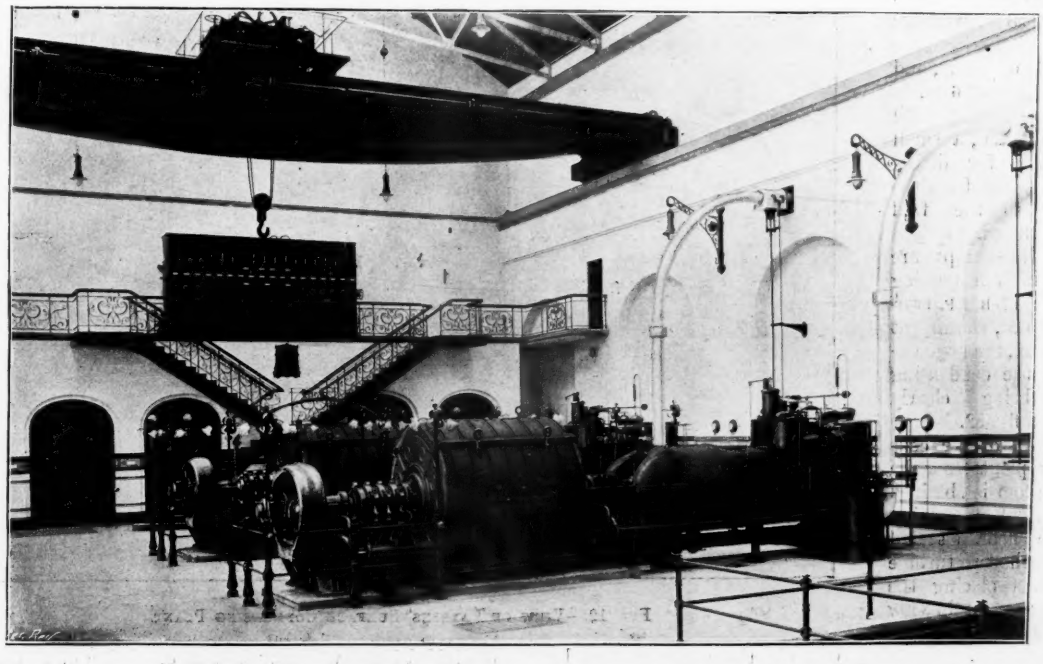


Fig. 10.—View of Engine Room, looking towards Switch Gallery.

The exhaust steam from the turbine falls direct into its own surface condenser, situated immediately underneath.

The condensers are of the usual circulating type, each having some 3,000 sq. ft. of cooling surface in the tubes.

Fig. 11.—B.T.H. High-Tension Switchboard.

Each condensing plant is provided with an 11-in. Gwynne centrifugal circulating pump, coupled direct to a 30-B.H.P. two-phase motor running at a speed of 750 r.p.m.; the pump having a rated capacity of 150,000 gallons per hour.

The air-pumps are Parsons vertical compound type, three-throw, running at a speed of 100 r.p.m., with pistons 8 in. and 18 in. diameter respectively in the upper and lower cylinders, and with a stroke of 6 in.

In connection with the air-pumps, a small force-pump for lifting the discharge from the hotwell to the feed pump is fitted.

The air-pumps are driven through gearing from an 11-B.H.P. two-phase motor, running at 500 r.p.m., the arrangement of the condensing plant being clearly shown in fig. 12.

Access to the condensing plant from the engine room is obtained by means of an opening in the floor, situated between the two turbine sets, thus placing the basement plant in view of the engineer-in-charge above, who also controls the pump motors by means of switchgear arranged in a cabinet against the engine room wall, and within easy reach of the stop valves on the turbines.

The circulating water for the condensers is drawn from the River Don, the water inlet being through strainers and sluices into a concrete chamber, which in turn is connected to a large culvert by means of a 36-in. diameter cast-iron pipe, 11-in. diameter suction pipes leading from the culvert to each circulating pump. The water is discharged through 14-in. pipes to a common main leading back to the river lower down.

In connection with the exhaust pipes from the turbines to the condensers are arranged galvanised steel branch pipes, each fitted with an automatic valve, and leading to a common vertical atmospheric exhaust pipe, also of steel, passing up through the boiler house roof behind the boilers.

For the whole of the general pipework, Messrs. Sir Hiram Maxim Electrical and Engineering Co., Ltd., have been responsible.

Drain connections are provided from the steam separators close to the turbines, and from the auxiliary steam-piping, &c., which discharge through steam traps of the float type into a drain tank situated in the basement. The traps are fitted with bye-passes, so that they can be operated by hand in case of emergency.

A motor-generator set of 50 KW. capacity is also installed in the engine room.

This consists of a direct-current generator, giving a pressure of 100 to 140 volts when running at 750 r.p.m. and coupled direct to a two-phase induction motor, working at 200 volts, E.M.F., and 50 ~ per second. This set is utilised as a reserve for excitation and for charging a small battery, shortly to be installed, and which will serve the purpose of an alternative source of supply to the principal station lighting circuits in the event of failure of the main supply.

This set and the auxiliary motors employed in the station, were supplied by the British Thomson-Houston Co., Ltd. A 20-ton travelling crane has been provided in the engine room, and is worked at present by hand ropes from the floor. This crane is adapted for conversion to electrical driving at a future date, if thought desirable; it, as also the outside crane, was supplied by the Chatteris Engineering Works Co., Ltd.

Running across the end of the station at some considerable height is the switchboard gallery.

On this is mounted a high-tension switchboard of the British Thomson-Houston make. It consists of nine panels of enamelled slate mounted in steel framework. The panels are divided into two groups, each consisting of a generator and three feeder panels; also one interconnector panel. They are equipped with B.T.H. automatic oil switches and horizontal edgewise instruments. Each circuit, with its

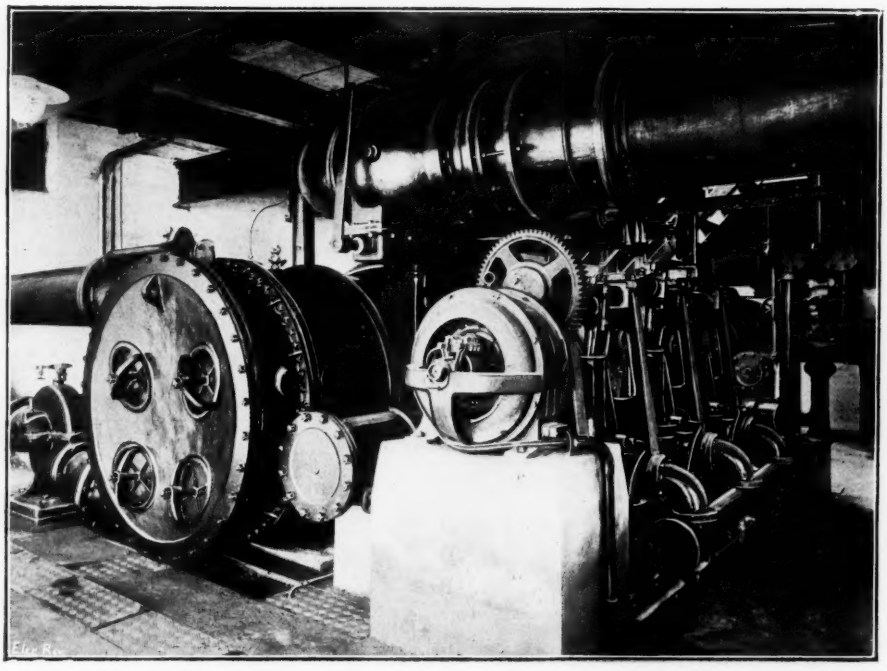


Fig. 12.—View of Parsons' Surface Condensing Plant.

apparatus, is protected by isolating slate barriers, and isolating switches are provided above the board, by means of which the apparatus on any circuit may be disconnected.

The whole of the switchgear, instruments, &c., situated in front of the board are connected up through series transformers, and are at low potential.

In the engine room basement, adjacent to the switchboard, is situated a small sub-station, where current required for local purposes, such as the motor and lighting circuits in the works, is transformed down. Here are installed two 40-KW. transformers for supplying at 100 volts, the lighting circuits, and three 100-KW. transformers for supplying at 200 volts the motor circuits, together with the necessary switchgear.

Owing to the variable bus-bar voltage when feeding the distributing centres, it has been found necessary to supply the local transformers through variable boosters, in order to keep the working voltage constant. These are of the Burnand type, and are wound in sections and connected up to multiple contact switches which are interlocked with reversing switches in the shunt winding; they enable a variation of 150 volts to be made, either up or down, on the primary feeders to the transformers.

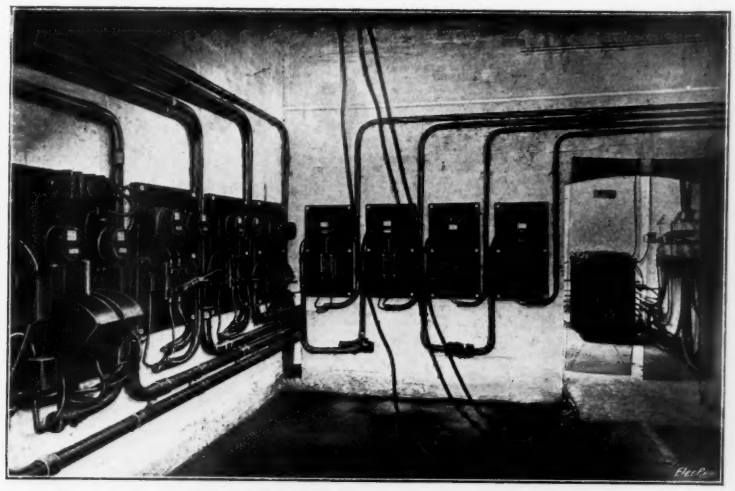


FIG. 13.—LOCAL TRANSFORMER AND METER ROOMS, NEEPSEND POWER STATION.

In the next chamber to that containing the transformers are placed the meters and main switches for controlling the various circuits, the arrangement being shown in fig. 13.

The station lighting is effected by means of 31 Davy arc lamps and 149 incandescent lamps, the whole of the wiring being carried out in Simplex screwed conduit, with iron-cased distribution boards, giving a continuous earthed metallic sheathing. This work has been carried out by the installation department, the cable and sub-station work by the construction department, and the transformers and the L.T. switchgear, &c., by the manufacturing department of the electricity supply undertaking.

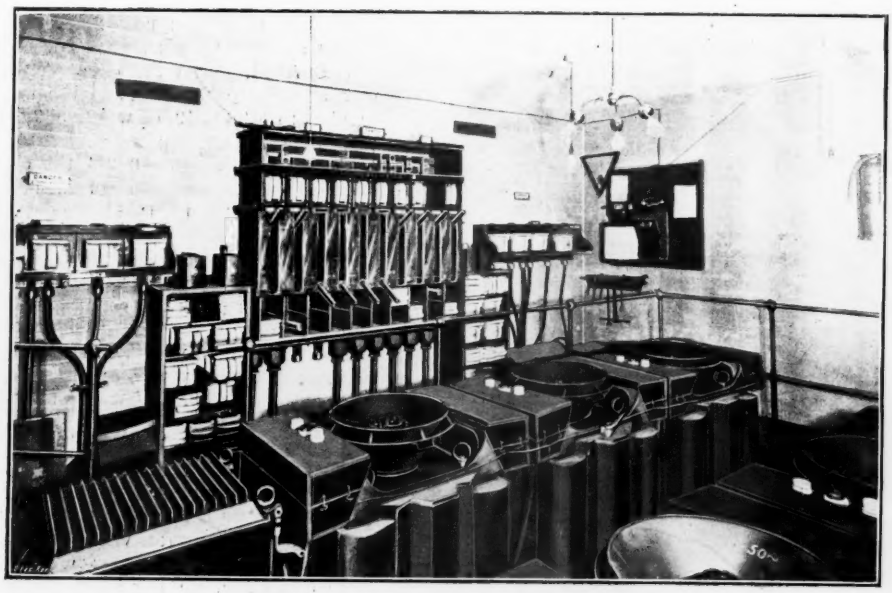


FIG. 14.—VIEW OF SUB-STATION UNDER TOWN HALL.

The whole of the architectural and engineering plans and specifications also were prepared by the staff, to the designs of the chief engineer, who has carried the work through; Mr. W. McDonald acting as his engineering clerk of works.

In order to connect up the new source of energy with the distribution network, fed at present from the old Sheaf Street station, it has been necessary to lay two pairs of ·5 sq. in. concentric trunk feeders, with a normal working pressure of 2,000 volts, across the intervening two miles.

These cables are of the well-known diatrine paper lead-covered type, jute covered; they were supplied by Messrs. W. T. Glover & Co., Ltd., and are drawn into 4-in. cast-iron pipes.

The original system of supply at Sheffield was a single-phase alternating one of 100 ~ per sec., but with a view to cultivating the use of motors, a change was made to two-phase, with a frequency of 50 ~ per second.

That this move on the part of the department has borne fruit, will be gathered from the fact that over 400 motors are now connected up, aggregating 2,300 H.P., and in sizes ranging up to 120 H.P.

The feeder and distributor network is a very considerable one, as will be gathered from fig. 19; the system of supply adopted is H.T. transmission to the transforming sub-stations scattered over the area, and normal distribution at 400 or 200 volts, although higher voltages are available for power purposes if necessary.

The transforming sub-stations present considerable variations in design, according to the several purposes for which they are adopted.

Fig. 14 illustrates a sub-station situated under the Town Hall. It is equipped, in common with others, with static transformers, the majority of which have been made by the Electricity Supply Manufacturing Department, under Mr. W. E. Burnand's patents, and which vary in size up to 500 KW., the standard sizes being 40 and 100 KW. Separate transformers are used on each phase, and the larger ones are air-cooled by means of electrical exhausting fans.

The H.T. switchgear employed consists of oil break fuses and switches, with and without automatic overload release attachments; on the L.T. side, the distributors are brought through sealing tailing boxes and duplicate fuses to the

L.T. bus-bars, which are fed by the transformers through similar fuses, an arrangement which provides for working in sections or banking the transformers.

Fig. 15 shows a sub-station as erected in residential districts, and fig. 16, a transforming and switching pillar,

FIG. 15.—VIEW OF SUB-STATION IN RESIDENTIAL DISTRICT.

with the front cover removed. This is practically a small iron street sub-station having a capacity of 40 KW., single-phase, and arranged to accommodate one in-coming H.T. feeder and two or three out-going L.T. distributors.

Fig. 17 shows a distributor disconnector pillar, for street work, fitted inside with tailing boxes for sealing the lead-covered cables, &c.

There are, of course, in use many sub-stations built in the

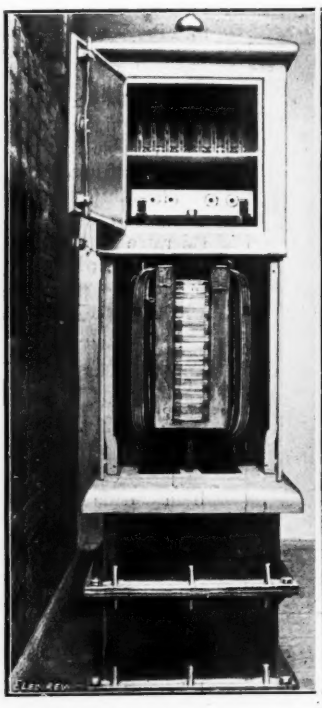


FIG. 16.—TRANSFORMING AND SWITCHING PILLAR.

FIG. 17.—DISTRIBUTOR DISCONNECTOR PILLAR.

form of pits, &c., and others situated on the larger consumers' premises.

At the present time, some 60 miles of feeder cables, and 64 miles of distributors, are in use in the city.

Before closing our review of the Sheffield undertaking and its plant, it is interesting to glance at the progress of the last 10 years.

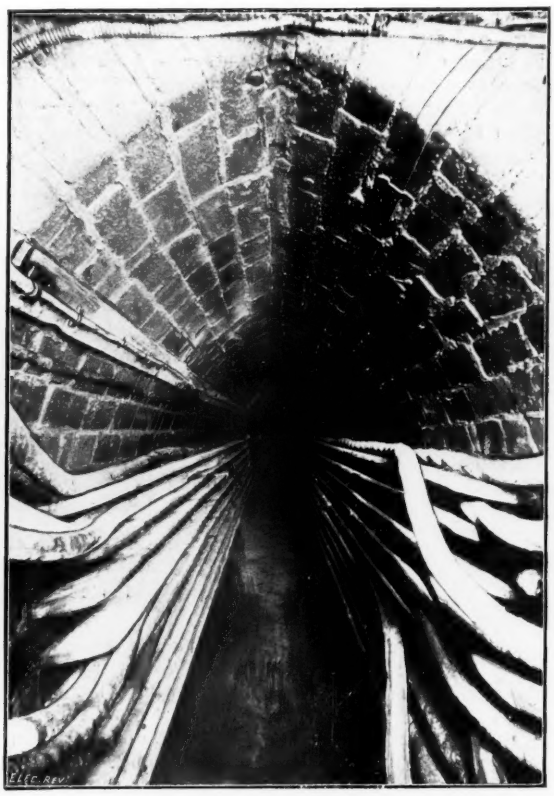


FIG. 18.—VIEW OF CABLE TUNNEL, IN THE CITY.

In 1894 the department had 150 consumers, and its revenue amounted to £5,610; some 14,697 equivalent 8-C.P. lamps were installed, and 192,220 units supplied, the amount used for the purpose of driving motors being practically negligible.

The returns for the period 1903-4 show that there are now 2,477 consumers, and that the gross revenue earned was £57,100. The lamp connections now amount to 276,000, and the units supplied to 3,980,049, of which 869,000 units were for motive power purposes.

During the period 1903-4 the total working costs, exclusive of financial charges, amounted to 1·03d. per unit, a figure which it may be confidently predicted will undergo considerable reduction as the new generating plant takes up the load, and power consumers are increased in number. The total capital expenditure on the undertaking amounts to £741,000, inclusive of the sum expended in buying out the old company and the latest additions at Neepsend.

This latter amounted to somewhat under £100,000, the engine room, at Neepsend, however, being constructed wide enough to accommodate turbines of 6,000 H.P., and sufficiently lofty for vertical engines of the same power.

In conclusion, we beg to express our thanks to Mr. S. E. Fedden, the manager and chief engineer, and his chief assistant, Mr. J. W. Beauchamp, for their courtesy in placing the resources of the department at our disposal for the purposes of this article.

[We omitted to state that the contractors for the steel chimneys at Neepsend were Messrs. Davy Bros., Sheffield, and for the railway weighbridge, Messrs. H. Pooley and Sons, Birmingham.]

TELEGRAPH AND TELEPHONE NOTES.

(*Continued from page* 138.)

Spain.—A company is in course of formation in Madrid, to introduce the Marconi system of wireless telegraphy into Spain. For the present it is only proposed to establish coast stations for communication with passing steamers. The first stations will probably be at Finisterre, Tarifa, and Palos.

Telegraphic Interruptions and Repairs :—

CABLES.	INTERRUPTED.	REPAIRED
Dominica-Martinique	May 9, 1902	
St. Lucia-Martinique	May 9, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Reissa-Issa (Yemen)-Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Dakar-Konakry	May 13, 1904	
Chio-Ténédos	June 21, 1904	
Paramaribo-Cayenne	July 13, 1904	
LANDLINES.		
Seoul-Masampo	Feb. 18, 1904	
Seoul-Gensan	Feb. 18, 1904	
Anju-Ping-Yang	Feb. 25, 1904	
Ninguta-Vladivostock	March 2, 1904	
Dominican lines	May 26, 1904	July 14
Saigon-Bangkok	July 1, 1904	July 13
Moulmein-Bangkok	July 13, 1904	

prevention of monopoly in that connection. Licences may be granted for the establishment and working of such undertakings by private companies. One provision of the measure confers upon the Government such powers as will enable them in time of war or grave emergency to take over or suppress or make use of all wireless telegraphs, so as to be of assistance to themselves, and also to prevent their being of use to the enemy. Further, the Bill will enable the Post Office to give to companies and stations such licences as will prevent them from interfering with other "wireless" systems.

Wireless Telegraphy between Japan and the U.S.A.—Mail advices from Washington, D.C., report that on June 28th a contract was signed between the United States Government and the De Forrest Wireless Telegraph Co., by the terms of which it will ultimately be possible to send wireless messages between New York and Japan. The Government, which will defray the cost of the various equipments, will have the use of the various installations for naval and other purposes, and the company will be bound to maintain them in good working order with the right to transmit commercial messages. In addition to the stations already equipped along the Atlantic coast from New England to Florida, the following new circuits will be provided:—Key West to Panama, 1,000 miles; Key West to Porto Rica, 1,000 miles; South Cuba to Panama, 720 miles; Pensacola to Key West, 450 miles; South Cuba to Porto Rica, 600 miles. The Panama station will be connected with a station to be erected in Southern California, which, in turn, will transmit messages to San Francisco and to Seattle, thence to Alaska and the Aleutian Islands, and finally to Kamschatka and Japan. The De Forrest Co. will also have stations in Hawaii and Guam, whence communication can be established with the Philippines, with a continuation to Wei-hai-wei, and an alternative route to Japan. The De Forrest Co., which was the highest of four competing bidders, has already equipped several ships in the U.S. navy, and tests prove that a vessel over 700 miles from the land can communicate with shore stations. The plant to be put in at Panama is estimated to be capable of sending messages to a distance of 3,000 miles, and that at Dutch Island, in the Aleutians, will be nearly as powerful.

FIG. 19.—PLAN OF MAINS NETWORK SHOWING GENERATING AND DISTRIBUTING STATIONS, SHEFFIELD.

Telephones in Nova Scotia.—Telephonic communication has been established between Halifax and Sydney, N.S., a distance of 292 miles. The wire is of copper, and is worked on the standard relay system. There are now in the province of Nova Scotia 3,260 telephones, or an average of one instrument to every 88 inhabitants, while in the city of Halifax the proportion is 1 to 27. Long-distance lines unite the principal towns, and last year the total number of messages transmitted was 14,000,000. Halifax answers 18,000 calls per day, or an average of 11 to each instrument, though some instruments reach a daily total of 150 messages. —*United States Consular Report.*

Wireless Telegraphy.—The United States Naval Wireless Telegraph Commission will soon report recommending the establishment of wireless telegraph stations at various strategical points on the sea coast. These stations will transmit all Government messages, including weather bureau information, and it is probable that commercial telegrams will also be accepted. The Treasury proposes to provide revenue cutters with wireless telegraph apparatus.

The Wireless Telegraphy Bill was introduced in the House of Commons on 18th inst. by **Lord Stanley.** It is essentially a measure for the regulation of wireless telegraphy, and provides for the

Royal College of Science.—Prof. Perry, whose enthusiasm is never keener than when he is seeking to benefit his fellow-creatures, has issued the balance-sheet of the secret bursaries by means of which, last year, 27 worthy students of slender means were assisted. Donations towards next session's needs will be gratefully received and judiciously bestowed.

CONTRACTS OPEN AND CLOSED.

OPEN.

Belgium.—Tenders are being invited until August 10th, by the Belgium State Railway authorities at La Bourse, Brussels, for the supply and installation of the plant, &c., required for the electric lighting of the railway stations at Flenu-Central, Warquignies, Jemappes, and Quaregnon-Central.

Bromley, Kent.—July 26th. A 15-KW. E.L. installation at the refuse destructor works. See "Official Notices" July 15th.

Bulgaria.—August 13th. The Municipal Authorities of Phillippopolis are inviting tenders until August 13th for the concession for the electric lighting of the town and for the construction and working of an electric tramway.

Cannock.—July 30th. Gas producers, two gas engines, two 80-KW. generators, booster, balancer, battery, switchboards, six 50-KW. transformers and cables. See "Official Notices" to-day.

Clyde.—July 25th. Two 32-ton electric coaling hoists for Clydebank Dock. See "Official Notices" June 17th.

Dover.—July 30th. Pumps and pipe work for the T.C. See "Official Notices" July 15th.

Dublin.—July 22nd. Machinery oils for 12 months. See "Official Notices" July 8th.

Dundee.—The T.C. wants tenders for the purchase of a number of Ferranti meters, 5 to 600 amps. direct-current. See "Official Notices" July 15th.

Fulham.—July 27th. Two water-tube boilers for the B.C. See "Official Notices" to-day.

Islington.—July 27th. Single-phase motor, and tail rods for engines. See "Official Notices" July 15th.

Johannesburg.—July 29th. Steel work for car-shed buildings, and bridge over railway. See "Official Notices" June 17th.

Leeds.—August 15th. Two 1,000-KW. turbo-alternators with condensers, exciters, and high and low-tension switchgear. See "Official Notices" to-day.

London.—October 4th. The L.C.C. wants tenders for centrifugal and other pumps for Greenwich power station. Particulars from Mr. G. L. Gomme, County Hall, Spring Gardens, S.W.

Mexborough.—August 2nd. Lancashire boiler for the U.D.C. See "Official Notices" to-day.

Perth.—August 16th. $4\frac{3}{4}$ miles tramways for the Corporation: permanent way, paving, and bonding, overhead equipment, cables, ducts, &c., cars and equipments, car depôt building. See "Official Notices" to-day.

Plymouth.—August 15th. (1) Steam alternator; (2) Lancashire boilers with accessories. See "Official Notices" July 15th.

Santos (Brazil).—August 20th. Power house plant consisting of producer gas plant and gas-driven alternators of a total of 400 KW. and transformers. See "Official Notices" to-day.

Shanghai.—July 30th. The Municipal Council invites tenders for a 24-mile electric trolley line concession. Particulars from J. Pook & Co., 63, Leadenhall Street, E.C., the London agents of the Council. See "Official Notices" May 13th.

Southampton.—July 25th. High-speed engine and condenser. See our advertisement pages to-day.

Spain.—July 30th. The Municipal Authorities of Belmez are inviting tenders until the 30th inst. for the concession for the electric lighting of Belmez, Pueblo Nuevo del Terrible, and Penarroya during a period of 7 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Belmez.

Spain.—August 4th. The Municipal Authorities of Fuentes de Andalucia are inviting tenders until August 4th for the concession for the electric lighting of the town during a period of 20 years. Tenders are to be sent to El Secretario del Ayuntamiento de Fuentes de Andalucia, whence particulars may be obtained.

Spain.—The Spanish Ministry of Posts and Telegraphs in Madrid is inviting tenders until the 27th inst. for the concessions for the establishment and working of telephone exchanges in the towns of Lerida and El Dano del Beal. Tenders are to be sent to La Direccion General de Correos y Telegrafos Carretos, 10, Madrid, whence particulars may be obtained.

Spain.—The Spanish Post and Telegraph Authorities in Madrid are inviting tenders until August 1st for the concession for the establishment and working of a telephone exchange in the town of Berga (province of Barcelona) with branch exchanges at Sallent, Gironella, Puigreig, Balsareny, Castelladral, and Cardona. Tenders are to be sent to La Direccion General de Correos y Telegrafos, Carretos, 10, Madrid, whence particulars may be obtained.

Walthamstow.—July 22nd. Cables, troughing, boxes, &c, for two years, for the U.D.C. See "Official Notices" July 8th.

Walthamstow.—July 26th. Supply and erection of arc lamps. See "Official Notices" July 15th.

Wimbledon.—July 25th. Refuse destructor extensions for the U.D.C. See "Official Notices" July 8th.

CLOSED.

Burslem.—The T.C. has accepted the following tenders in connection with the new E.L. works:—

Messrs. Babcock & Wilcox, Ltd., boilers	£1,087
Sir Hiram Maxim E. & E. Co., Ltd., piping, pumps, &c.	1,009
Messrs. Dick, Kerr & Co., Ltd., engines and dynamos	1,863
General Electric Co., balancer and booster	327
Crompton & Co., switchboard	598
Callender C. & C. Co., cables	9,554
Crompton & Co., arc lamps	448
Electrical Power Storage Co., accumulators	780

Cardiff.—The Corporation has just placed an order with the South Wales Motor Co. for two motor-wagons, for use in connection with the maintenance of the overhead conductors.

Cleckheaton.—The U.D.C. has accepted the tender of the Phœnix Dynamo Manufacturing Co., of Bradford, for a 350-KW. generating set, comprising a triple-expansion engine, by Messrs. Gourley Bros., of Dundee, and steam dynamos.

Coventry.—The tenders of Messrs. Marshall, Fleming and Jack, for the supply of an electric crane, at the price of £540, and of the British Westinghouse Co. for the supply of the electrical equipment of the crane, amounting to £223, have been accepted by the E.L. Committee.

Croydon.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for pipe work on the generating station extensions, at £997.

Deptford.—The B.C. has accepted the tender of the Phœnix Dynamo Manufacturing Co., of Bradford, for supplying and fixing two steam dynamos and a booster in connection with the electric lighting of the Town Hall and Municipal Offices, for £777. There were 29 tenders, ranging from £614 to £920, but several were rejected as not complying with specification. The tender of the Electric and Ordnance Accessories Co., Ltd., of Birmingham, for supplying and fixing a switchboard and connections at £340 was accepted. There were tenders from 26 firms ranging from the amount of the accepted tender to £775.

Erith.—The Brush Electrical Engineering Co., Ltd., has secured the contract to supply Messrs. W. Cory & Son, Ltd., Erith, with a 220-KW. Brush three-crank steam dynamo.

Lincoln.—The T.C. has accepted the following tenders in connection with the electrification of the tramways:—

Brush Electrical Engineering Co., Ltd., eight trucks and eight car-bodies.
British Westinghouse Electric & Manufacturing Co., Ltd., eight electrical equipments, two magnetic track brakes and spares.

Marylebone.—The Electric Supply Committee has received the following tenders:—

For the erection of a generating station:

Foster & Dicksee, Rugby	£69,096
Bott & Stennett, 25, Victoria Street, Westminster	67,234
James Stewart & Co., Savoy Hotel, W.C.	66,612
McCormick & Sons, Northampton Street, Essex Road, N.	64,321
Mayoh & Haley, Amberley House, Norfolk Street, Strand, W.C.	63,000
E. Lawrence & Sons, 14 to 16, Wharf Road, N.	62,300
John Mowlem & Co., Ltd., Grosvenor Wharf, Westminster, S.W.	61,244
Henry Lovatt, Ltd., 40, North End Road, Kensington, W.	60,500
Wellerman Bros., Hyde, Cheshire	60,256
Allen Fairhead & Sons, Enfield	59,987
John Grover & Son, Wilton Works, New North Road, N.	59,750
F. & H. F. Higgs, Station Works, Loughboro' Junction, S.E.	59,100
F. G. Minter, Ferry Works, High Street, Putney, S.W. (recommended)	57,524

The above tenders include the structural steel work, which is to be executed by Messrs. Dorman, Long & Co., for £16,924.

For the supply and erection of electric generating and other plant, the tender and proposition of Messrs. C. A. Parsons & Co., of Heaton Works, Newcastle-on-Tyne, at £79,598, is recommended. The other firms tendering were the British Westinghouse Co., Ltd., London; British Thomson-Houston Co., Ltd., Rugby; Messrs. Willans & Robinson, Ltd., Rugby; and Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. The tenders include an electric crane to be supplied by Messrs. C. A. Musker, Ltd., of Liverpool, at £930, and cooling towers to be supplied by the Klein Engineering Co., Ltd., Manchester, at £8,600.

For supply and delivery of cables, &c.:—

W. T. Henley's Telegraph Works Co., Ltd., London Wall, E.C.	£96,860 0 0
W. T. Glover & Co., Ltd., Trafford Park, Manchester	95,640 0 0
Siemens Bros. & Co., Ltd., Westminster, S.W.	94,220 0 0
Callender Cable & Cons. Co., Ltd., Victoria Embankment, London	89,500 0 0
British Insulated & Helsby Cables, Ltd., Prescot, Lancashire	88,906 10 0
W. F. Dennis & Co., 49, Queen Victoria Street, E.C.	79,510 0 0
Western Electric Co., North Woolwich, E.	78,477 6 8
St. Helens Cable Co., Ltd., Warrington, (Lancs.) (recommended)	78,165 12 9

Two tenders and propositions were received for the supply and erection of steam generating and other plant. The consulting engineer reported that that sent in by Messrs. B. R. Rowland and Co., Ltd., Reddish, Stockport, was unsuitable. The other tender, that of Messrs. Babcock & Wilcox, Ltd., 30, Farringdon Street E.C., at £55,202, was recommended.

Pietermaritzburg.—The Corporation has ordered six top deck covers for tramcars, from the Brush Electrical Engineering Co., Ltd.

Rochdale.—The T.C. has accepted the tender of the Electrical Engineering Co. for a dynamo and Belliss engine for the electricity works.

St. Pancras.—The B.C. has received the following tenders for the supply of carbons:—

Veritys, Ltd.	(accepted)	£229	0 6
F. Henrion		245	12 9
Sloan Electrical Co.		252	16 4
De Grelle Houdret & Co.		261	0 10
Brockie-Pell Arc Lamp, Ltd.		296	3 2
Brush Electrical Engineering Co.		301	19 0
International Electric Co.		311	8 0
Electrical Co., Ltd.		311	17 0
Ditto.		558	5 0
Ditto.		650	16 0
General Electric Co.		313	4 8
Birmingham Carbon Co.		313	4 8
Johnson & Phillips		317	13 11
Siemens Bros. & Co.		366	11 5

Southport.—The Electricity Committee of the T.C. has accepted the following tenders:—

Messrs. Proctor & Co., stoker	£73 0 0
Messrs. Dick, Kerr & Co., Ltd., 200-kw. alternator	608 10 0
Messrs. Belliss & Morcom	41 9 0
General Electric Co., Ltd., balancer and booster ..	337 0 0
Messrs. Crompton & Co., switchboard	598 0 0
Messrs. Callender & Co., cables	9,554 1 8
Messrs. Crompton & Co., arc lamps	443 0 0
Electrical Power Storage Co., accumulators	780 5 0

Southwark.—The B.C. has accepted the following tenders for coal for the electricity department:—Messrs. Bradbury, Son & Co., Ltd., for 1,000 tons, at 17s., of Welsh Powell Duffryn best washed peas; Messrs. Spencer, Whatley & Co., for 3,000 tons, at 13s. 7d., of West Hallam small nuts.

Stalybridge.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board has accepted the tender of Messrs. W. & T. Avery, Ltd., for the supply of a 10-ton self-contained weighbridge, and that of Messrs. Wm. Ellis & Sons for a 10 cwt. platform weighing machine on wheels.

Stepney.—The B.C. has received the following tenders for annual supplies:—

Meters up to 10 amperes:—The Reason Manufacturing Co., Ltd. (accepted), £312 10s.; Messrs. Chamberlain & Hookham, Ltd., £325; Ferranti, Ltd., £326 5s.

Meters above 10 amperes:—Messrs. Ferranti (accepted), £518 8s.; Chamberlain & Hookham, £544 15s.; Reason Manufacturing Co., £550 5s. Five tenders were rejected as not complying with specification.

Demand indicators:—Reason Manufacturing Co. (accepted for both types), magnetic, £451 7s., thermal, £583 7s.; Schattner Electricity Meter Co., Ltd., magnetic, £487 2s. 6d.

Carbons:—F. Henrion, description Henrion, £317 6s. 2d.; Sloan Electrical Co., Ltd. (accepted), description Conradty, £331 1s. 5d.; Crompton & Co., description Conradty, £357 14s. 6d.; Johnson & Phillips, description Conradty, £364 2s. 5d.; Birmingham Carbon Works, description Witton, £378 2s. 6d.; General Electric Co., Ltd., description Witton, £403 12s. 9d. Six tenders were rejected for not complying with the specification.

Coal:—11 tenders were received, and that of Messrs. G. & C. Hinchcliffe was accepted at the following prices, either in bulk or in sacks:—Bwllfa, large, 21s. 3d., small, 15s.; Nixons, large, 23s.; Mardy, large, 23s., small, 16s.; Tynsfail, large, 23s.; Llangennech, large, 22s. 6d.; Penrikyber, 23s.; Nottingham, large, 16s. 6d., small, 12s.

Walthamstow.—The U.D.C. has accepted the following tenders for the annual supply of electrical stores:—Messrs. Johnson and Phillips, lamps, Nernst lamps, shades, I.C. cut-outs and switches, casing and capping, carbons, globes (part of); Messrs. F. Suter & Co., switches and cut-outs, distributing boards, &c., conduits, bends, &c., waste, &c., carbon brushes, globes (part of), Para strip (part of); Henley's Telegraph Works, cables; Messrs. Edison & Swan, holders, ceiling roses, &c.; the Brush Electrical Co., Para strip (part of).

Winchester.—The T.C. has accepted the tender of Messrs. Manlove, Alliott & Co., of Nottingham, for the provision of a refuse destructor.

NOTES.

Electricity Works and Tramways Tables.—

ILKESTON.—The electrical engineer and tramways manager is Mr. A. C. Gilbert.

LANCASHIRE AND YORKSHIRE RAILWAY.—The electrical equipment of this railway is under the charge of Mr. George Hughes, chief mechanical engineer to the company, not Mr. Worthington, as stated in our table.

South African Notes:—

Pretoria (Transvaal).—At the Town Council meeting at Pretoria on June 17th, discussion took place on the taking over by the Town Council of the Pretoria Lighting Co. A special committee was appointed with the Mayor as chairman to meet the directors of the company in order to discuss the proposals made by the company in their letter of October 30th last; and if necessary to engage an expert to value the plant and buildings, &c., of the company.

Mowbray (Cape Colony).—At a meeting of the Mowbray Council on June 16th, the Sanitary Committee reported that Mr. Smart, one of the directors of the Cape Peninsula Lighting Co., had waited on the Acting Mayor and engineer and asked for an extension of time with regard to the signing of the agreement arranged between the Town Council and the company. Mr. Smart informed the Acting Mayor that as they had not sufficient power at the Claremont station to satisfactorily provide for private consumers at Mowbray, the company had decided to erect an additional station in Mowbray for that purpose, which would be put in hand at once, and completion was promised in three months from June 1st. The reason for the application was that under agreement the company bound themselves to provide satisfactory power to private consumers, and the company felt they could not fulfil this obligation pending the construction of an additional station. It was then agreed to give the company the three months' extension, subject to the company removing the 30 poles now obstructing the lighting of the street by gas. This action was approved of by the committee, who also recommended a further condition, that the reduction in tariff to consumers (referred to in the agreement) from 1s. 9d. to 1s. 6d. per unit, should take place forthwith. The report was adopted.

Johannesburg (Transvaal).—The Tramway and Parks Committee has recommended an additional capital expenditure of £17,550 for the erection of married and single men's quarters on the site of the generating station, to accommodate four married foremen and 75 single men. The Finance Committee of the Town Council estimates that the municipal expenditure for the coming year will be £1,850,000, of which tramway bills amount to £150,000; tramway track and buildings, £380,800; and tramway and lighting scheme, £350,000.

Potchefstroom.—Mr. M. Astley Shute, electrical adviser, Army Headquarters, Pretoria, intimates that sealed tenders addressed to the Commanding Royal Engineer, South Africa, and marked "Tender for Electric Lighting, Potchefstroom," will be received at Army Headquarters, Pretoria, until September 7th, at 12 noon, for the electric lighting of the cantonments, Potchefstroom.

Port Elizabeth.—At a meeting of the Harbour Board, a letter was read from the town clerk to the effect that the T.C. was expecting to have its own electrical installation, and therefore could not sanction any private body supplying light to private consumers. This was in reply to a letter from the Harbour Board asking the T.C. whether it was agreeable to the Board supplying electric light to the public offices, &c.

The report of Messrs. Hammond and Sons, regarding the electric lighting of Port Elizabeth, came before the Town Council on June 22nd, being a criticism of Mr. Pape's report, the borough electrical engineer, which was submitted to them. Messrs. Hammond are in favour of a H.T. system, in place of the three-wire L.T. system proposed.

The T.C. discussed the report, and it was resolved to recommend that it be adopted, in terms of the Electric Lighting and Power Act, No. 42, of 1895, and that the scheme be at once submitted to the Government electrical engineer. Further, that Mr. Pape be instructed to proceed to England as soon as possible, in order to arrange for Messrs. Davis and Soper to call for tenders for plant. After further discussion, it was decided to defer the matter for three weeks, and that in the meantime the report be forwarded to the Government electrical expert.

L.C.C. Amenities.—In his "Current Topics" last week, "Elektron," of *Electricity*, makes some feeling remarks on the subject of the L.C.C. conduit tramways. We are informed, in one breath, that the cars are a great boon to the public, and that the number of breakdowns is alarming. A lady is informed (we are told) by a conductor that his car will go to Westminster "if we don't have an accident!" The natural inquiry whether such an occurrence is probable brings the astounding answer, "We have so many accidents that we have ceased to take notice of them"!!—after which every stoppage throws the lady passengers into a panic. An optimistic friend of "Elektron's" suspends his railway season ticket, in order to enjoy the pleasant drive on the cars during the summer; but once in three days he has to have recourse to the electric "Peashooter," or the humble but triumphant 'bus, owing to breakdowns on the cars, which have even occurred three days in succession—presumably a novel form of the hat trick, in emulation of heroic deeds at the Oval. Electric heating appears to be in vogue inside the cars, for "to sit on the centre seats is like sitting on an electric hot plate," and the effect on unsuspecting passengers is described as quite amusing. Most cruel cut of all, the 'buses outpace the electric cars, and "generally the 'bus gets in a long way ahead."

To live on the south side, and to depend on the Council's up-to-date, speedy, and comfortable cars as they literally *plough* their way citywards, must be at least an interesting experience, according to "Elektron" and his veracious friend.

St. Louis Exposition.—A correspondent warns visitors to the St. Louis Exhibition that no stranger can drink the public supply water of the city without serious effects. It requires, he says, a longer time to become acclimatised to the water than most people can afford to give to the Exhibition. Visitors are recommended to drink only mineral waters, or they will assuredly spend the time of their visit sick in a most expensive city.

On Wireless Telephony by Means of Hertzian Waves.—In a recent issue of *La Energia Electrica*, Madrid (May 25th, 1904), Mr. G. J. de Guillén Garcia records some interesting experiments made by him in conjunction with his son. In connection with some wireless telegraph researches, the son of the author happened to note that in the telephone of the Tommasi coherer located at the receiving station, there was a sound difference according to the air-gap in the interrupter of the Rhumkorff apparatus. This suggested the idea that a similar apparatus would be susceptible of transmitting the human voice to a distance without the agency of the wire, and after some delay the author was enabled through the courtesy of Prof. Marcel, of the Barcelona Seminary, to carry out his idea.

The experimental arrangement is a simple one: at the transmitting station there is a Rhumkorff apparatus of 3 cm. spark length, as well as the necessary oscillator, a small antenna and a grounded conductor. Between the transformer (*i.e.*, the Rhumkorff coil) and a small battery of Grenet cells, there is a special microphone acting both as manipulator and as interrupter. The automatic interrupter of the induction coil is stopped, while the condenser is used for reinforcing the oscillator spark. At the receiving station, there is a Tommasi coherer, connected to the receiving antenna and the grounded conductor. In a telephone receiver, the noise produced by the Hertzian waves on traversing the coherer is noted.

On approaching the mouth of the microphone and singing or speaking, every sound vibration will be attended by an interruption in the passage of the electric current through the primary circuit of the transformer, the number of sparks in the oscillator thus being varied. The underlying principle shows, therefore, some analogy with the mechanism of an ordinary telephone. The results obtained in the reproduction of singing are said to be quite satisfactory, whereas the rendering of speech leaves much to be desired. The trouble seems to be the difficulty of designing a microphone of sufficient intensity; Mr. Garcia, it is true, has remedied the imperfections of his apparatus to a certain extent by using a condenser and augmenting the potential difference. This, however, could not be driven too far, lest electric arcs be formed.

Condenser Temperature.—The steam which leaves a cylinder is often made to pass through a feed heater on its way to the condenser. The idea at the bottom of this practice is that the steam fresh from the cylinder must be much hotter than steam in the condenser. It is, however, a well-recognised fact that saturated steam at a given pressure can have only one temperature corresponding with the pressure. This is axiomatic for saturated and for wet steam. The pressure in the cylinder of a well-proportioned engine at once drops very near to that existing in the condenser, and such being the case, it is very doubtful if for any appreciable time any serious value can be got out of the steam as a feed heater by means of that type of surface condenser which passes the feed through a few preliminary pipes. It would be worth experimenting with thermometers placed at intervals in the track of the exhaust steam from the cylinder to the condenser with a view to noting the curve of temperature. It can hardly be questioned before the experiment that if the temperature is high there will be an exactly corresponding pressure, and if back pressure is resorted to, to gain temperature, it would be just as well to use less water and keep the condenser warmer also.

The Energising Momentum Engine.—Mr. B. C. Pole informs us that after six years and three months of hard work, together with producing a momentum engine for the Imperial Institute at Charlottenburg, the German patent is now officially allowed. "The engine involves the discovery of mechanically-made power, destroys the modern theory of energy, and is the forerunner of universal electric light, heat, and power."

We have expressed our opinion of the performance of the Momentum Engine on previous occasions, both in our own columns and in the Law Courts; it is impossible, however, not to admire the persistent energy of Mr. Pole in his indefatigable pursuit of perpetual motion.

Specific Heat of Superheated Steam.—Mr. Emmett, of the General Electric Co., claims that tests made at Schenectady have shown the following values for the specific heat of superheated steam:—At 155 lbs. gauge pressure the value for saturated steam was 0·52. Then at 100° of superheat it was 0·65; at 150°, 0·70; at 200°, 0·74; and at 250°, 0·77. Neyrauch has recently investigated the question, and according to him the specific heat varies from 0·4682 for saturated atmospheric steam up to 0·6177, at 14 atmospheres and 572° F. Evidently more decisive experiment is wanting. The discrepancy is too great to admit of reliance being placed on both sets.

A Vacuum Regulator for Crookes Tubes.—Bunsen has studied the capillary attraction of a glass surface for gas, and shown how to increase the extent of the absorbing surface of a glass receiver by introducing into it glass filaments like those used in weaving glass tissues. M. Krouchkoll (*Comptes Rendus*, May 30th) has applied this fact to the regulation of the vacuum of a Crookes tube. A tube communicating with the Crookes tube or bulb and containing glass cotton is fused to the bulb, so that when, by the working of the bulb, the vacuum becomes more resistant, heating the glass tube containing the "cotton" will reduce the resistance. The tube with the glass filaments is, in fact, a reservoir of gas communicating with the vacuum tube. This regulator is easy to make, and, so to speak, automatic. When the anti-cathode grows warm the heat disengaged in the bulb sets free a little of the gas in the glass cotton and keeps the tube in an invariable condition for a long time.

Northampton Institute Students' Dinner.—The annual dinner of the day students took place on Friday, 8th inst., at Anderton's Hotel. The chair was taken shortly after 8 o'clock by one of the students, Mr. W. Stanley Lonsdale, and among the guests present were the Principal, Dr. R. M. Walmsley, Dr. C. V. Drysdale, Mr. C. E. Larard, and Mr. S. Field, with their respective senior lecturers and assistants, altogether numbering 42. After the dinner a very good programme was gone through; the musical items being interspersed with the toasts. In reply to the toast of the "Institute and Principal," Dr. Walmsley gave some very good advice to the leaving students, especially as to what could be learnt in works from the practical man. Dr. Drysdale, in replying for the electrical department, corroborated Dr. Walmsley's remarks, and made some humorous allusions to the "self-induction and resistance" of students. Mr. Larard, for the mechanical department, was also very humorous in his remarks, and his advice both as regards works, and social instincts, should be carefully borne in mind by all those present. Mr. Field, in replying for the chemical department, pointed out the importance of a good knowledge of electro and metallurgical chemistry to the engineer, as a lot of metals, &c., important to him, were now being largely produced by electrolytic means, aluminium being an example. With several very good songs and pianoforte solos by the students, a very enjoyable evening was brought to a close.

Historic Incandescent Lamps at St. Louis.—Mr. W. J. Hammer, consulting electrical engineer of New York City, and formerly chief assistant to Mr. Thomas Alva Edison, will exhibit at the St. Louis Exposition a collection of about 700 incandescent electric lamps, including the first experimental lamps made by Mr. Edison. The collection is said to be complete and unique, and includes a specimen of every kind of filament lamp ever made in America or Europe. Of particular interest are a number of "fake" lamps produced as evidence at trials for patent infringements, and originally alleged to have been made prior to Mr. Edison's invention.

Institution of Electrical Engineers.—The following are the names of the gentlemen who have been appointed by the Institution as Delegates to attend the International Electrical Congress to be held at St. Louis:—

Mr. R. Kaye Gray, President.
Col. R. E. Crompton, C.B., past-president.
Prof. John Perry, F.R.S., past-president.
Dr. R. T. Glazebrook, F.R.S., member of Council, and Mr. H. E. Harrison, B.Sc., B.A.

Mr. W. Duddell will act as hon. secretary to the delegation. The two last-named gentlemen have previously served on the Council of the Institution. The Congress will open on Monday, September 12th, and will meet daily until Friday, the 16th.

Institution of Civil Engineers.—According to the provisional arrangements of the American and Canadian Societies of Civil Engineers, the visit of the Institution will commence with a week at New York, followed by a week in Canada; after a visit to Chicago, the party will proceed to St. Louis, arriving there on September 30th. Special trains will be provided, and the Erie and Milwaukee Railway Companies will allow free passages over their entire systems to members of the party. At St. Louis the visitors will follow their own inclinations, but they are cordially invited to attend the International Engineering Congress on October 3rd to 8th. The secretary of the Institution, Dr. J. H. T. Tudsbery, advises those who propose to take part in the visit to make arrangements at once. The party will sail by the ss. *Etruria* from Liverpool on September 3rd.

Appointments Vacant.—Huddersfield, general manager and engineer for the tramways, at £350 per annum; an assistant electrical engineer is wanted at Oban, at £70 per annum; Lowestoft, assistant electrical engineer for mains and tramway overhead line, £112; a chief instructor in mathematics is required at the Northampton Institute at £150 per session. See "Official Notices" to-day.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the power station or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*]

Central Station Engineers.—The Crewe T.C. has appointed Mr. GWILLIAM as assistant engineer at the electricity works at a salary of 45s. per week.

The Tramways and Electricity Committee of Darlington T.C. has recommended an increase of £100 a year in the salary of Mr. J. R. P. LUNN, manager of the electricity works and tramways.

Mr. JAMES P. GALLINAGH has been appointed electrical engineer to the Limerick Corporation.

Mr. H. A. BARNETT has been appointed resident engineer to the Clyde Valley Electrical Power Co., Ltd.

Mr. W. H. JAY, chief engineer of the Durham E.L. works, was married at Folkestone on July 11th to Miss Florence Peden, sister of the Mayor of Folkestone.

Electric Tramway Officials.—Halifax T.C. has appointed Mr. C. SPENCER, son of the tramways manager, as superintendent of the rolling stock and trainer of tramway drivers at a salary of 50s. per week.

Mr. H. N. THOMAS, manager of the Huddersfield Corporation Tramways, has been appointed manager of the Durban City Tramways at a salary of £800 per annum. Mr. Thomas's present salary is £400; he was superintendent of the electrical equipment of the Isle of Man Tramways before going to Huddersfield.

General.—Mr. F. W. TAYLOR, the district manager of the National Telephone Co. at Reading, was last week presented by the staff of the local depôt with a handsome silver tea service, on the occasion of his leaving Reading to take up the post of district manager at Brighton. Mr. Taylor will be succeeded by Mr. J. Sinclair Terras.

NEW COMPANIES REGISTERED.

Lemmon & Co., Ltd. (81,576).—This company was registered on July 14th, with a capital of £2,100 in £1 shares, to acquire the business of surgical electricians carried on by R. J. Lemmon and H. Scholey at 19, Hanover Square, W., as Lemmon & Co., to adopt an agreement with the said vendors, and to carry on the business of electricians, engineers, suppliers of electricity, manufacturers of anatomical, orthopœdic, and surgical appliances, boot, stay, and corset makers, artificial eye and limb makers, drysalters, manufacturers of chemical and other preparations, &c. The first subscribers (each with one share) are:—H. R. Willis, 5, Sandrock Road, Lewisham, Poor Law clerk; R. J. Lemmon, 27, Bloemfontein Avenue, Shepherd's Bush, W., electrical engineer; A. W. Lemmon, 27, Bloemfontein Avenue, Shepherd's Bush, W., clerk; H. A. Nicholls, 27, Bloemfontein Avenue, Shepherd's Bush, W., clerk; M. H. Lemmon, 27, Bloemfontein Avenue, Shepherd's Bush, W., clerk; Mrs. E. Nicholls, 27, Bloemfontein Avenue, Shepherd's Bush, W., clerk; and Miss C. C. Nicholls, 27, Bloemfontein Avenue, Shepherd's Bush, W. No initial public issue. The first directors are not named.

Electric Fog Signal Co., Ltd. (18,540).—This company was registered on July 12th, with a capital of £10,000 in £1 shares, to acquire any inventions relating to railway fog signalling, in particular to acquire the benefit of certain existing inventions for an electric fog signalling apparatus, to adopt an agreement with R. A. D. Gough, T. Templeman, and G. N. Pratt, and to turn to account any such inventions as aforesaid. The first subscribers (each with one share) are:—R. A. D. Gough, 129, High Street, Uxbridge; T. Templeman, Montague Road, Slough; G. N. Pratt, 122, High Street, Uxbridge, H. Morten, 28, High Street, Uxbridge; J. Tidd, 6, Crofton Road, Camberwell, clerk; G. Wilcocks, 54, St. Andrews, Uxbridge, coach builder; and W. H. Bird, Uxbridge, solicitor. No initial public issue. The subscribers are to appoint the first directors; qualification, £100; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bath Electric Tramways, Ltd. (74,278).—A mortgage, dated July 1st, 1904, to secure not more than £10,000, has been registered. Property charged: The undertakings authorised by the Bath and District Light Railways Order, 1901, and the Bath Electric Tramways (Light Railways Extensions) Order, 1903, and all permanent ways, sidings, stations, power houses, sheds, rolling stock, plant, &c., appertaining thereto, certain leasehold land in the parish of St. Michael, Bath, with buildings, fixed plant, &c., thereon, and the company's general assets, present and future. Holders: Union of London and Smith's Bank, Ltd., 2, Princes Street, E.C.

Charing Cross and Strand Electricity Supply Corporation, Ltd. (29,122).—A trust deed, dated June 17th, 1904 (supplemental to trust deeds, dated respectively April 30th, 1901, and September 12th, 1902), to secure a further £180,000 debenture stock, created by resolution of April 27th, 1904, ranking *pari passu* with £250,000, and £150,000 debenture stock covered by said prior trust deeds, and making therewith a total of £580,000 debenture stock, has been registered. Property charged: The assets comprised in said trust deed of April 30th, 1901. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.; and J. Trotter, 2, Princes Street, E.C.

Eastern Telegraph Co., Ltd. (6,338 C).—Issue, on June 15th, of £10,000 debenture stock, being the whole of a series created by board resolution of even date. Property charged: The company's undertaking and revenue. Holder: F. R. de Levante, 141, Hill Street, Peckham, S.E. Debenture stock previously issued: £1,849,120.

Ingleton Electric Lighting and Power Co., Ltd. (60,796).—A debenture, dated June 21st, 1904, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital, subject to debentures dated June 22nd, 1900; June 31st, 1901; January 29th and August 8th, 1902, securing £1,200, £800, £200 and £400 respectively, has been registered. Holder: J. C. Walker, Glenholme, Ingleton, Yorks.

Midland Electric Corporation for Power Distribution, Ltd. (53,071).—A memorandum of satisfaction in full of a mortgage dated November 13th, 1902, securing £100,000, has been filed.

Birmingham and Midland Tramways Ltd. (19,077).—A trust deed, dated June 14th, 1904, to secure £200,000 first debenture stock (with power to issue further stock ranking *pari passu* up to half the subscribed capital for the time being), has been registered. Property charged—(Specifically): Certain land at Smethwick, a power house in course of construction, tramways owned by the company, except those which it is under obligation to sell, and securities in certain tramway companies. (As a floating security): The company's remaining assets, present and future. Trustees: Electric and General Investment Co., Ltd., 1—2, Great Winchester Street, E.C.

West Coast of America Telegraph Co., Ltd. (52,114).—This company's annual return was filed on May 21st, when 45,000 shares had been taken up out of a nominal capital of £182,520 in 53,008 shares of £2 10s. each. £2 10s. per share has been called up on eight shares, resulting in the receipt of £20. £112,500 is considered as paid on 45,000 shares. Mortgages and charges: £170,000.

Harrington Electric Light Co., Ltd. (44,135).—This company's annual return was filed on May 21st, when 3,900 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £3,900 has been paid. Mortgages and charges: nil.

Siemens Bros. & Co., Ltd. (14,777).—This company's annual return was filed on June 14th, when the entire capital of £600,000 in 120,000 shares of £5 each had been taken up and paid for in full. Mortgages and charges, £150,000.

Ackroyd & Best, Ltd., Lamp Manufacturers, Morley (54,600).—A trust deed dated June 2nd, 1904, supplementary to trust deeds dated April 9th and May 14th, 1903, respectively, securing £15,000 10 per cent. debentures, and £2,600 debentures, part of said series, issued on June 2nd, has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: C. T. Naylor, Dean House, Kilmiston, Alresford Hants, and J. P. Humble, Threelands, Birkenshaw, Yorks.

British Electric Calibrated Fuse Co., Ltd. (78,488).—Issue on July 11th of £100 debentures, part of series created December 4th, 1903, securing £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. Lang, 187, Fenchurch Street, E.C. No trustees. Previously issued of same series, £1,650.

Otto Electrical Manufacturing Co., Ltd. (Manchester). (80,263).—Issue on June 23rd, of £1,500 debentures, part of series created June 22nd, 1904, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. Deakin, The Hall, Wormhill, near Buxton, Derbyshire. No trustees. No previous issue of same series.

Moelline Co., Ltd., electric and general engineers, London, (76,689).—Issue on June 22nd of £125 debentures, part of series created March 29th, 1904, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any). No trustees. Previously issued of same series: £12,250.

Cutting Bros., Ltd., electrical engineers, Derby (81,178).—£4,000 debentures, created June 20th, 1904, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

Issue on June 20th of £2,600 debentures, part of series created same date to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Isle of Thanet Electric Tramways and Lighting Co., Ltd. (49,978).—A trust deed dated July 6th, 1904 (supplemental to two trust deeds dated January 18th and August 5th, 1902, respectively, securing £50,000 debenture stock), has been registered. Property charged:—The company's undertaking and property, present and future. Trustees:—City Safe Deposit and Agency Co., Ltd., 13, Throgmorton Avenue, E.C.

New General Traction Co., Ltd. (47,321).—A trust deed dated June 22nd, 1904, to secure £80,000 prior lien debentures has been registered. Property charged: shares in the Norwich Electric Tramways, Coventry Electric Tramways, and Douglas Southern Electric Tramways, bonds of the Philadelphia, Morton, and Swarthmore Street Railway Co., Ltd., and the Media, Middleton, Aston, and Chester Electric Railway Co., and the company's other assets, present and future, ranking in priority to a trust deed dated June 28th, 1901, securing £200,000 debentures and certain agreements. Trustees: Trustees', Executors', and Securities Insurance Corporation, Ltd., Winchester House, E.C.

ELECTRICITY SUPPLY ACCOUNTS.

Sunderland Municipal Electricity Supply.

THE returns of this seaport borough are usually found not wanting in interest, and this year is no exception to the rule. It will be recalled that the department has laid itself out to cultivate a power load, and how well it has succeeded can be appreciated from a study of the annual report. With a load factor of 19, as against 15 per cent., an output 23 per cent. ahead of last year, and a reduced peak load, the year's working has turned the previous year's temporary deficit into a net profit of £1,246, although the power load has only been in operation for a third of that period. As financial charges will be on a descending scale per unit in the future, there appears to be every reason to wish the department success in its "power" venture.

The prices charged are:—For private lighting, 5d., with discount, or 5d. and 2½d. maximum demand; power, 2½d., with discounts; traction, 1⅞d. per unit; public arcs, £14 per annum. The chief engineer is Mr. John F. C. Snell.

GENERAL STATEMENT.

For year ending March 31st—	1904.	1903.
Total capital expended	£284,918	£225,997
Number of units sold—		
Private supply	1,643,299	1,217,223
Public lighting	302,092	295,460
Traction	1,562,748	1,335,660
Total number of units sold ...	3,508,139	2,848,283
Equivalent No. of 8-C.P. lamps connected	197,683	154,923
H.P. of motors connected	2,270	927
Number of public lamps	165	157
Maximum load in KW.	2,079	2,165
Revenue account—		
Gross revenue	£36,128	£31,325
„ expenditure	£19,769	£18,509
„ profit	£16,359	£12,816
Average inclusive price obtained per unit—		
Private and traction supplies per meter	2·54d.	2·71d.
Public lighting	1·8d.	1·76d.

REVENUE ACCOUNT FOR YEAR ENDING MARCH 31ST, 1904.

Gross revenue	£36,128 = 2·47d. per unit.	
Works and distribution costs (including public lighting)	£14,184 = ·97d.	„
Total working costs	£19,769 = 1·35d.	„

PROFIT STATEMENT.

Interest on loans	£7,999
Sinking fund...	7,114
Balance carried forward	1,246
Gross profit ...	£16,359

Manchester Municipal Electricity Supply.

THE returns of this, the "biggest Municipal electrical show" in Britain, are especially interesting in view of the fact that the department possesses a little matter of 12,000 H.P. more than is likely to be required for a few years. The department has made exceptional progress in output, and its revenue is some £70,000 better than last year, for an increased working expenditure of £17,000; the gross profit of £138,480 suffices to cover financial charges (which are some £20,000 heavier through the unproductive extensions) and enables a renewals fund of £25,000 to be instituted—the balance of £6,000 going to swell the reserve fund, which now amounts to £32,000.

The prices charged are:—Private lighting, 5½d. flat, or £7 per KW., maximum demand, per annum, and 1¾d. per unit; power, 1½d. to 1d. per unit; traction, 1½d. per unit. The chief engineer is Mr. A. L. Pearce.

GENERAL STATEMENT.

For year ending March 31st—	1904.	1903.
Total capital expended	£2,110,432	£1,713,627
Number of units sold—		
Private supply	11,799,214	9,373,846
Public lighting...	41,553	40,305
Traction	17,125,857	7,986,072
Total number of units sold ...	28,966,624	17,400,223
No. of lamps connected	412,000 8-C.P. inc. 3,000 arc	352,000 8-C.P. inc. 2,690 arc
H.P. of motors connected	6,142	3,298
Number of public lamps	29	29
Maximum load in KW.	17,290	12,775
Revenue account—		
Gross revenue	£267,788	£197,170
„ expenditure	£129,308	£112,316
„ profit	£138,480	£84,854
Average inclusive price obtained per unit—		
Private supply...	3·66d.	3·62d.
Public lighting...	2·00d.	2·02d.
Traction	1·50d.	1·65d.

REVENUE ACCOUNT FOR YEAR ENDING MARCH 31ST, 1904.

Gross revenue	£267,788 =	2·22d. per unit.
Works and distribution costs	£102,054 =	·84d. „
Total working costs	£129,360 =	1·07d. „

PROFIT STATEMENT.

Interest on loans	£57,472
Sinking fund	44,156
To Public Works Commissioner's loan	5,043
Carried to renewals suspense account	25,000
Balance carried forward	6,809
Gross profit	£138,480

CITY NOTES.

Electrical Power Storage Co., Ltd.

THE annual general meeting of the above company was held at the offices, 4, Great Winchester Street, on Thursday afternoon, under the chairmanship of Mr. J. I. Courtenay.

The CHAIRMAN, in moving the adoption of the report, said it was a pleasure to him to be able to report good results from the past year's working. The directors felt justified in again recommending a dividend of 6 per cent., and transferring £3,500 to reserve and £1,000 to the contingent fund. They had expended £1,459 6s 5d. in equipping the property with further plant and the latest labour-saving appliances, and had, besides thoroughly maintaining the works out of revenue, amply provided for depreciation at a cost of £1,603 12s. 6d. Sundry debtors were about £2,000 larger than at May 31st, 1903, while sundry creditors were smaller, and full provision had been made against bad and doubtful debts. Investments were unaltered, and cash and bills receivable were increased by about £1,500. Competition had been more severe than ever, and the cutting of prices a marked feature of the year's business. The works were very busy, and although the actual turnover was rather smaller than that of the previous year, it was satisfactory to note that the value of orders received was larger, showing that they commenced the new financial year with more orders in hand. These orders included batteries for some 18 central stations in various parts of the country and abroad. At the last annual meeting he alluded to the sensational notices in certain newspapers regarding what was called the Edison battery. He had only now to add that the experience of the 12 months that had since elapsed confirmed the doubts he then expressed as to the excessive merits claimed for it. This type of battery had been given an extended trial in a vehicle in this country. It took up more space and was approximately the same weight as their own lead battery, but after a run of about 3,000 miles he was informed that it had been sent back to its native land. It was important to remember that no inventor in particular had a monopoly of these accumulators with alkaline electrolyte. Experiments in alkaline batteries were being pushed on by themselves, and they felt confident that if a successful battery was to be made, this company would not be behind others in putting one on the market. During the year there had been no relaxation in their efforts towards the improvement of the batteries, both for traction and other purposes, and no trouble or expense was spared under Mr. Butler's supervision in testing and ascertaining the value of all improvements, or reputed improvements, that were brought to their notice. Several alterations had also been carried out during the year at Millwall works, with the object of assuring greater comfort and health to the workmen.

Sir JAMES PENDER seconded the motion, and the report was adopted without discussion.

On the motion of the CHAIRMAN, seconded by Mr. F. GREEN, Sir J. Pender was re-elected a director.

Mr. BARCLAY congratulated the board on the satisfactory balance-sheet, and said few companies of a similar description would be able to show as good a balance-sheet as last year, but their company was an exception. He moved a hearty vote of thanks to the board and the staff.

The motion having been carried, the CHAIRMAN replied, and remarked that new accumulators came out about once a month, and after attracting the usual amount of capital to the scrap heap, nothing more was heard of them. At the same time, this had an unsettling effect on the minds of customers, as well as shareholders. The company was now accustomed to this class of work, and had an experience, he believed, unrivalled in the world.

Direct United States Cable Co.

THE report of the directors for the six months ended June 30th, 1904, to be presented at the fifty-fourth ordinary general meeting of the company, on Tuesday, the 26th inst., at 2 p.m., states that the half-year's revenue, after deducting out-payments, has amounted to £43,121 6s. 5d., as compared with £48,886 12s. 7d. for the corresponding period of 1903, showing a difference of £5,765 6s. 2d. The working and other expenses for the same period, including income-tax, amounted to £21,185 11s. 2d., leaving a balance of £21,935 15s. 3d. as the net profit, making with £2,479 8s. 10d. brought forward from the previous half-year, and £1,965 17s. compensation for surrender of lease of premises at New York, a total of £26,381 1s. 1d. For the corresponding period of 1903, the working expenses and other payments amounted to £21,724 0s. 7d. Three quarterly interim dividends of 3s. each per share amounting to £27,319 10s. have been declared and paid during the financial year, and a final dividend of 3s. per share is now proposed, making with the three interim dividends, 3 per cent. for the year, being a total distribution of £36,426. After transferring £6,000 to the reserve fund account, the balance of £2,168 1s. 1d. on the revenue account is to be carried forward. The reserve fund account has been debited with £11,725 0s. 7d. for cost of cable repairs, and after being credited with interest on the investments and amount transferred from revenue, the balance now amounts to £463,952 16s. 9d., taking the investments at cost price. Two of the directors, viz., the Hon. Thomas H. A. E. Cochrane, M.P., and John Varley, Esq., retire by rotation, and, being eligible, offer themselves for re-election. Messrs. Deloitte, Dever, Griffiths & Co., and Messrs. J. and J. Sawyer & Co., the auditors, retire pursuant to the articles of association, and offer themselves for re-election.

General Electric Co.

THE report of the directors for the year ending March 31st last, to be submitted at the ordinary general meeting to be held on 27th inst., at 12.30 p.m., shows that the net trading profits and income from investments, &c., amount to £83,864 14s. 1d.; after deducting depreciation and debenture interest amounting to £25,607 14s. 11d., there remains a balance of £58,256 19s. 2d., out of which the dividend on the preference shares at the rate of 5 per cent. for the year ended March 31st, 1904, has been paid, absorbing £12,500, and leaving an available balance of £45,756 19s. 2d., which the directors recommend should be appropriated as follows:—To payment of managing directors' and employés' bonuses £4,575 14s.; dividend on ordinary shares at the rate of 7 per cent. for the year ended March 31st, 1904, £21,126; reserve account, £20,055 5s. 2d. The reserve account stands in the accounts at £60,210 2s., being the amount of undivided profits as at March 31st, 1903. The proposed appropriation of the undivided profit of the year ended March 31st, 1904, amounts to £20,055 5s. 2d., giving a total reserve account of £80,265 7s. 2d. The trading profit must be deemed satisfactory, considering the general depression of trade. The Witton engineering works and foundry are now in full working order. The favourable anticipations expressed in last year's report have been realised, and the number as well as the nature of the contracts in hand are very encouraging for the future. The position of the carbon works is much improved. The Manchester and Birmingham factories continue to show good results. During the year further 1,342 ordinary shares have been allotted to the directors of the company at par. Mr. M. Railing retires by rotation from the position of director and offers himself for re-election. The auditors being eligible, offer themselves for re-election.

Metropolitan Electric Supply Co.

A special meeting of the shareholders took place on the 19th inst. to consider resolutions in regard to the distribution of the money paid to the company by the Marylebone Borough Council.

Mr. H. Cripps, who presided, said that the company had received from the Borough Council a sum of £1,318,000; of this, £600,000 was to be divided as a bonus of £6 per share, and £100,000 placed to reserve, making the reserve fund £230,000. A sum of £500,000 was regarded as capital; it was proposed to deal with this by giving every holder of two £10 shares three £5 shares and £5 in cash, leaving the capital of the company at £750,000 instead of £1,000,000, but this would require an Act of Parliament. The Sardinia Street award was £183,000, which would be spent on new machinery and sub-stations. The debenture holders were going to apply for an injunction to restrain the directors from dividing the £700,000 on the ground that it was capital, but he had no doubt the matter would be settled in the company's favour.

The resolution approving of the directors' proposals was carried unanimously, and a sum of £7,000 was voted to the board. The general manager and staff are also to receive generous bonuses.

Anglo-Argentine Tramways Co.

An extraordinary general meeting of this company was held at Winchester House on 18th inst., to consider the terms of a provisional agreement made with the City of Buenos Ayres Tramways Co. for the purchase of the undertaking of the latter.

Lord R. H. Browne, who presided, said that after the amalgamation they would control 104 miles of tramways. The resolution was carried, with three dissentients, and a further resolution increasing the capital by £600,000 was also carried. The city lines are to be electrified, the contractors taking £650,000 in ordinary shares for carrying out the work.

City of Buenos Ayres Tramways Co.

A similar meeting to the above was held at the same place by this company to authorise the amalgamation. The Anglo-Argentine Co. is to provide £42,250 as compensation to the directors and staff. Resolutions were passed approving the agreement, and authorising the necessary steps to wind up the company voluntarily.

Chili Telephone Co.

Mr. George Keith presided at Winchester House, Old Broad Street, E.C., on Wednesday morning, over the fifteenth ordinary general meeting of the Chili Telephone Co, Ltd., and in moving the adoption of the report, said the business of the company had for some years been making steady progress. The shareholders had been receiving gradually increasing dividends, and the financial position of the company had, at the same time, been strengthened. The position now was such, that the directors felt themselves justified in commencing an interim distribution, and there was every reason to expect that could be continued in future years. He thought they would agree with him that the accounts were very satisfactory. The revenue in Chili had increased in the past year about 9 per cent. Some 443 new subscribers had been added to the subscription list, and there had been a considerable increase in message and sundry receipts, all of which had been added to the revenue. The increase in business naturally led to a corresponding increase in working expenses. The expenditure in Chili had increased about 5 per cent, and worked out at 46 per cent. on the revenue, which was rather less than last year. When it was considered that all the improvements and changes to the plant were charged against revenue, he felt that the rate of working was a satisfactory feature and reflected great credit upon the management in Chili. The result of the year's business in Chili was a net income of £33,687, showing an increase for the year of £4,964. After they had added interest and discounts, and transfer fees, and deducted London expenses and charges for debenture interest and income-tax, there was a net profit for the year of £28,570. After adding to that £2,637, brought forward from last year's accounts, there was an available balance for distribution of £31,267. An interim dividend of 3s. per share had been already paid, and £14,010 transferred to the reserve fund, and the directors now recommended the payment of a final dividend of 4s. per share, making a total dividend for the year of 7 per cent, and leaving £2,502 to be carried forward to the next account. The debenture interest stood at £35,000, as compared with £56,000 last year. The issue fell due on March 31st, when £21,000 was paid off, and the remaining £35,000 had been extended by the re-issue to the holders with a view to their being paid off as the finances of the company admitted. The payment of such a large amount had drawn somewhat heavily upon the cash resources of the company, but it meant a saving in debenture interest of £1,260 per year, which would go to the profits. The capital expenditure during the year of £1,296 had gone on new stations. An additional circuit had been put up between Santiago and Valparaiso to meet the growing traffic between these two cities. Altogether, 679 miles of new wire had been equipped and added to the property. Since the arrangement with the Argentine, the Chilian people had been able to devote more attention to industry and commerce, and, as the business of the company showed, there had been a gradual advancement going on in the country, which he thought was likely to continue. The nitrate and other industries were doing very well, and the harvest had been good. The adjustment of public expenditure and revenue was improving the financial position of the country, and they might look forward to more prosperous times in Chili, and the continued success of their business.

The Hon. H. T. Allsopp seconded the motion, and the report was adopted.

Electric Construction Co.

The eleventh annual general meeting of the shareholders of this company was held on Thursday of last week at Winchester House, Old Broad Street, Mr. J. W. Barclay in the chair.

The Chairman, in proposing the adoption of the report, said that the accounts were of a somewhat mixed character, for while the decrease in profits was unsatisfactory, on the other hand the financial position of the company had greatly improved, and gave the directors increased confidence in the future. Out of the £19,167 available for dividend, they recommended a 4 per cent. dividend on the ordinary shares, to be paid on July 30th, £2,000 to be added to the reserve fund, leaving a balance of £3,805 3s. to be carried forward to next year. They would observe that the whole 4 per cent. dividend on the ordinary shares was to be paid on the 30th of this month, instead of one-half then and the other on January 30th, as formerly. That change had been made in deference to the wishes of shareholders, but they must warn them that no interim dividend for next year would be paid, because they thought it injudicious in such a business as theirs to pay any dividend from profits until the accounts made up at the end of the financial year showed what profits had been earned. The profit and loss account showed a decrease of £6,643 in manufacturing profits, brought about by the excessive competition they had had to meet during the last year, and an increase of £103 from other sources. The total expenditure on the debit side of the account showed a small decrease of £576. The fact was, economies had previously been carried so far that little scope remained for proceeding further in that direction, and their great aim had been to increase the output of the works; in that respect they had been to some extent successful, for they had turned out a larger volume of work during the year than ever before. The important feature in the balance-sheet was the reduction of the loan from the company's bankers from £60,000, as appeared in last year's accounts, to £10,000 in those now submitted; and, further, that balance had since been paid. That result had been reached by selling the company's interest in the Crystal Palace District Electric Supply installation, which formed part of the assets of the old Corporation; while the Madras electric tramway undertaking had been transferred to the Madras Electric Tramways (1904), Ltd., in consideration partly of cash and partly of shares. The price was fixed on the basis of last year's tramway profits, which showed equal to a dividend of 5 per cent. on the shares of the new company, and as that was an improving property, the directors expected that this dividend would be at least maintained. It might be in their recollection that the assets of the old Corporation were taken over for a lump sum, which was divided amongst the various properties according to the best judgement of the directors; but, as might naturally be expected, the best of the assets were sold first, and yielded a profit, part of which was added to the reserve fund. Realising the two properties now dealt with had, on balance, resulted in a loss of about £4,000, and that loss had in turn been debited to the general reserve fund, reducing its amount to £30,000. But to continue the policy of the last few years, it was proposed to appropriate £2,000 of the profits of this year to the reserve, and thus, practically, the reserve fund was reduced by only £2,000. As stated in the report, they had granted, as usual, a bonus to those of their employés who had given 12 months' good and faithful service, but at a reduced rate in proportion to the dividend. They had experienced excessive competition during the last year, especially during the last six months, and the competition still continued. That statement might appear somewhat vague, but he had had some figures prepared which would enable them to realise for themselves the position of the electrical manufacturing business. Those figures showed that the prices of certain classes of electrical machinery were on an average 40 to 50 per cent. less than they were in 1900—that was a fall of nearly one-half in four years. And when he told them that the cost of raw material was very little less now than it was then, they would appreciate more fully the skill in design and economy in processes that had enabled them to earn any dividend at all. The orders on hand included, amongst others, important contracts with the London County Council, and with the Great Western Railway Co. for their new electrical installation at Park Royal. He attached much importance to this contract with the railway company, because he had no doubt that electric traction would be more and more largely adopted by railways, and he had no doubt their engineers would give satisfaction in this department, as they had in the past. If they had not had a larger share of recent railway equipments, it was probably because several of the more important contracts had been combined with financial operations, into which they declined to enter. They would probably ask how long this competition was to last. He was sorry to say that was a question he could not answer. He would, however, tell them that it was not foreign competition that had brought prices down to their present level, for they were now lower than any prices of Continental or American manufacturers quoted in this country. Within the last few years new factories had been established both in England and in Scotland, and although he looked for a large development in the use of electric power, they must expect and be prepared for keen competition for some time. They were well equipped for the struggle. Their works were up to date, they spared no expense in adopting labour-saving machinery, they had full confidence in the skill of

their engineers and in the zeal and ability of their employés. There must be a time of stress, but the fittest would survive, and he would only add that they meant to be of the number.

Mr. P. E. Beachcroft seconded the motion, and the report was adopted.

Stock Exchange Notices.—The Stock Exchange Committee has (1) appointed special settling days as under:—Wednesday, July 27th.—Anglo-Argentine Tramways Co., Ltd., 120,000 ordinary shares of £5 each, fully-paid, Nos. 260,008 to 380,007; Metropolitan Railway Co.—£500,600 3½ per cent convertible preference stock. And (2) ordered the undermentioned securities to be quoted in the official list:—Anglo-Argentine Tramways Co., Ltd.—120,000 ordinary shares of £5 each, fully-paid, Nos. 260,008 to 380,007; British Electric Traction Co., Ltd.—further issue of 1,235 ordinary shares of £10 each, fully-paid, Nos. 232 067 to 233,301; Metropolitan Railway Co.—£500,000 3½ per cent. convertible preference stock.

Anglo-American Telegraph Co.—The directors have resolved, after placing the sum of £6,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending June 30th, 1904, of 12s. 6d. per cent. on the ordinary stock, and £1 5s per cent. on the preferred stock, less income-tax, payable on July 30th, to the stockholders registered on the books of the company on June 30th, 1904. After paying the foregoing dividends, there will be a balance of about £2,500 to be carried forward to the next account.

City of London Electric Lighting Co.—Warrants in payment of dividends on account of the distribution for the year 1904 on this company's preference and ordinary shares have been posted.

Dublin and Lucan Electric Railway Co.—For the half-year ended June 30th, 1904, the directors propose a dividend of 1⌀ per cent. on the preference shares (reducing the arrears to nine months), placing £100 to reserve account, and carrying forward a balance of £161 to next half-year.

Prospectus.—The Telephone Co., of Egypt, has been inviting subscriptions at par for an issue of £60,000 of 4½ per cent. redeemable debenture stock. The proceeds will be applied to the repayment of a loan of £6,500, and an existing issue of £10,500 5 per cent. debentures, and to the provision of extensions of the company's system. The company has entered into a contract with the Egyptian Government to supply for 25 years from 1899, the telephone service required by the Government in the chief towns and suburbs where the company has a public service, and holds other Government contracts for communication between villages in various provinces. The lists opened on Wednesday and closed yesterday.

Eastern Telegraph Co.—The directors announce a final dividend of £1 5s. per cent., and a bonus of £2 per cent. on the ordinary stock, making a total distribution of 7 per cent. for the year ended March 31st last.

Electric Supply Corporation.—Issue of 46,600 shares of £5 each. Allotment letters were posted on Monday last.

Metropolitan Railway Co.—A dividend is declared on the ordinary stock for the past half-year at the rate of 3 per cent. per annum, carrying forward about £21,000, and crediting £11,500 to reserve fund. The dividend on the surplus lands stock will be at the rate of 2⅞ per cent. per annum. The dividend on the ordinary stock compares with 2½ per cent. a year ago, when £26,255 was carried forward.

City and South London Railway Co.—The accounts for the half-year ended June 30th, after transfer to the renewal fund of £1,500, allow the payment of a dividend on the consolidated ordinary stock at the rate of 2½ per cent. per annum, carrying forward £704. The dividend for the corresponding period last year was at the rate of 2¾ per cent. per annum, carrying forward £1,500.

The South London Electric Supply Corporation.—The company reports that the accounts for the half-year ended June 30th show a net profit of £14,149, against £5,210 for the corresponding six months of last year.

Central London Railway Co.—A dividend for the half-year ended June 30th of 4 per cent. on the undivided ordinary and preferred ordinary stocks has been declared, and a dividend at the same rate on the deferred ordinary stock, provided for and payable at the end of the year's working. The balance brought forward is £48,737, including £37,000 from the previous half year.

STOCKS AND SHARES.

Wednesday Evening.

Stock Exchange markets are in a curiously irregular condition, the fall in consols, due to politics and dearer money, failing to greatly influence Home Rails, which are now leaning upon the dividend announcements and estimates. With Americans good and South Africans weak, the chief speculative departments are perplexing the operators in both, and between the investment sections and those in the speculative area, the usually steady stocks are mostly marking time. For another six weeks no increase of trade can be reasonably looked for, and the disappointment with regard to the Money Market is a further discouragement to any business which might otherwise be astir in these summer days.

City and South London Ordinary stock has not quotably altered upon the declaration of the dividend at the rate of 2½ per cent. per annum, which really squares with the market anticipation we mentioned last week. Some curiosity was aroused as to why the declaration should have come later than usual, but, after all, the delay was only a few days. The rate is ¼ per cent. less than was paid this time last year, but the price has suffered very severely in the interval, being now about 48½ against 67 a year ago. The Metropolitan Railway's dividend at the rate of 3 per cent.—an increase of ½ per cent.—met with general satisfaction, and the price of the stock is slightly better at 97. Metropolitan Surplus Land stock, which will receive at the rate of 2⅜ per cent., is 78. East London Ordinary has been done at 4$\frac{11}{16}$, the little improvement shown by the half year's accounts being deemed good. Districts have shrunk ½ to 37½. The traffic on the South Harrow extension is increasing by slow steps, but the connecting link with Uxbridge is being rapidly pushed on, and the new joint line ought to prove a useful adjunct. Central London stocks continue dull, and the Ordinary has slipped back a point, to 90½, the dividend at the rate of 4 per cent. notwithstanding. Waterloo and City remains at 90½, and here the announcement should be made on Thursday, July 28th.

In the Electricity Supply market, Edmundson's Ordinary are ¼ better, at 6¼, on the good dividend recently announced, the declaration of which put the price of the Preference firmer a week ago. Metropolitan Electric Supply, after being nominally 10s. easier, at 21, rose to 21½ upon the directors posting cheques to the proprietors for £6 per share, the injunction applied for by the debenture-holders not having been granted. Several varieties have been quoted *ex* dividend, and the 4½ per cent. Debenture stock of the Blackheath and Greenwich Co. is *ex* 25 per cent. bonus in stock. Allowing for this, the price has really risen some 3 points, and a smaller advance put County of London 4½ per cent. Debenture stock to 106½. City of London Preference have recovered their 6s. dividend, while the Ordinary at 11 show a loss of the 5s., which is represented by the distribution. Westminsters, at 6¼, have lost a similar fraction, the dividend in their case being 2s. 6d. a share. Notting Hill shares, at 14, are 10s. up, and Charing Cross Preference have gained ⅛, at 5⅜. It is announced that letters of allotment for the new Electric Supply Corporation shares have been posted, and, as nothing is said about letters of regret, one may reasonably suppose that the public response did not necessitate these last.

Buying of Edison & Swan Prior-charge stocks by the insiders has advanced the "A" Debenture to 79½, and the Second Debenture 3 points to 80 middle. It is quite likely that the rise has not yet been exhausted, but this hint must be construed as a suggestion not to sell rather than as a "tip" to buy, the market being exceedingly limited, and the stock difficult to negotiate in any quantity at the best of times. The "A" shares have risen ½ to 12s. 6d. Callender's Debenture is 2 down at 102, but no change has occurred in the shares. Henley's have not yet recovered from their dulness, and Crompton Debentures at 95½ have lost half their 2 points rise of last week; the shares at 2 are unchanged. British Westinghouse Preference at 3½, and the Debenture stock at 86½, call for no special comment. British Thomson-Houston Debenture remains at 102.

Coming to Traction varieties, British Electric Traction Ordinary are again ¼ lower at 8⅜; the Preference keep about 10⅞, and the First Debenture stock retains its slight improvement. Auckland Debenture at 99, and Anglo-Argentine Tramways Preference at 5½ are both firm. City of Buenos Ayres Trams are still 10. British Columbia Electric Railway stocks have apparently reached a resting-place for a while, and business in them is now quiet, but the Buenos Ayres and Belgrano issues are somewhat to the fore; the Ordinary are being done about 3, and the 5 per cent. Second Debenture at 102½. London United Debenture is a point up at 104, and rises have taken Calcutta Trams to 7½, and Barcelonas to 8½.

Eastern Extension Telegraph shares have regained the dividend of 2s. 6d. deducted last pay-day, and the list of Telegraph Ordinary issues is absolutely with fluctuation. Eastern 3½ per cent. Preference, under a slight pressure to sell, is a point lower at 86½, and West Coast of America 4 per cent. Debentures have parted with their 2 points rise of a week ago. Telegraph Constructions are also their dividend of 12s. to the good at 37½, and a few improvements have taken place in the National Telephone issues, the most important being a rise of £1 in the first Preference shares. Monte Video Telephone Ordinary have put on a fraction at 10s. Globe Telegraph Preference found favour with investors, and at 13½ are 5s. better on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1901.	1902.	1903.	Closing Quotations July 13th.	Closing Quotations July 20th.	Business done week ended July 20th, 1904. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	97 —101	97 —101	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2½— 3½	2½— 3½	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	.. — ..	70 — 80	..	..
788,840	Anglo-American Telegraph	Stock	61s.	60/6	61s.	46 — 49	46 — 49	..	..
3,105,680	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	91 — 93	91 — 93	92⅝	91⅝
3,105,680	Do. do. do. Deferred	Stock	2s.	1/-	2s.	6½— 7	6½— 7	..	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	6 %	7 %	5 — 5½	5 — 5½	..	..
18,333,300$	Commercial Cable	$100	8 %	8 %	..	170 —190	170 —190	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	93 — 95	93 — 95	95	94
16,000	Cuba Telegraph	10	4 %	6⅔ %	5 %	6½— 7½	6½— 7½	..	..
6,000	Do. 10 % Pref.	10	..	..	..	15 — 16	15 — 16	..	..
12,981	Direct Spanish Telegraph	..	..	..	..	.. — ..	.. — ..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
80,000	Do. do. 4½ % Debs.	50	..	..	..	98 —101	98 —101⅝	..	..
60,710£	Direct United States Cable	20	8½%	8½%	8 %	10 — 10½	10 — 10¼	10½	..
81,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,900, Red.	100	..	..	..	99 —101	99 —101	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	126 —131	126 —131	131	129
1,955,565	Do. 8½ % Pref. Stock	100	..	..	..	87 — 90	86 — 89	88½	87½
1,534,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	105 —108	105 —108	107	105⅝
300,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	11⅞— 12½	11⅞— 12½ xd	12⅛	12
250,000£	Do. 4 % Deb. Stock	Stock	..	..	..	105 —108	105 —108	107	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1909	100	..	..	..	99 —102	99 —102	101	100
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102	99 —102	..	..
180,227	Globe Telegraph and Trust	10	5½%	£3 16 7*	5½%	8⅞— 9⅛	8⅞— 9⅛	9	8⅞
180,042	Do. do. 6 % Pref.	10	..	..	..	13— 13½	13½— 13⅝	..	..
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	12½%	15 %	25½— 26½	26½— 26½	..	..
54,700	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	99 —101	99 —101	..	..
17,000	Indo-European Telegraph	25	10 %	10%	10 %	42 — 45	42 — 45	..	..
1,983,888	National Telephone, Pref. Stock	100	5 %	6 %	6 %	106 —108	106 —108	107½	106
1,966,667	Do. do. Def. Stock	100	..	4½%	5 %	89 — 92	89 — 92	92⅝	90½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11 — 13	12 — 14	13 7/16	12⅝
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	..	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5½— 5⅝	5½— 5⅝	5 1/16	5⅛
600,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97 — 99	97 — 99	98½	97⅝
689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	103 —105	103 —105	104½	..
1,000,000	Do. do. Prov. Certs., 70 % to be paid	..	..	..	..	29 — 31	29 — 31	..	..
179,313	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	6⅔%	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	..	..	1 — 1⅛	1 — 1⅛	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100	..	..
11,889	Reuter's	8	5 %	5 %	..	6¾— 7⅛	6¾— 7⅛	..	..
3,808	Submarine Cables Trust	Cert.	..	..	..	118 —123	118 —123	..	..
56,000	United River Plate Telephone	5	7 %	7 %	..	6 — 6¼	6 — 6¼	..	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4¾— 5¼ xd	4¾— 5¼	5 1/16	4⅞
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	103 —106	103 —106	..	..
15,609	West African Telegraph, Shares	10	..	2 %	4 %	6 — 7	6 — 7	..	..
150,000£	West Coast of America, 4% Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	..	..	..	97 —100	95 — 98	96	..
267,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	12½— 13	12½— 13	12 1/16	12½
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	101 —104	101 —104	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	99 —102	99 —102	100½	99½
68,321	West India and Panama Telegraph	10	..	..	..	⅜— ½	⅜— ½	..	..
84,568	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6½— 6¾	6½— 6¾	6⅝	6½
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	5 — 6	5 — 6	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,600	100	..	..	..	99 —102	99 —102	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	5 — 6	5 — 6	5½	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	..	..	..	92 — 97	92 — 97	..	..
100,000	British Electric Traction	10	9 %	8 %	..	8½— 9½	8½— 9 xd	8⅝	8⅜
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	10½— 11	10½— 11	10⅝	10 7/16
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	116 —119	116 —119	..	..
100,000	British Insulated and Helsby Cables	5	10 %	10 %	8 %	5⅝— 6⅛	5⅝— 6⅛	..	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5⅝— 6⅛	5⅝— 6⅛	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	101 —104	101 —104	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	..	..	⅜— ½	⅜— ½	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	..	..	14/6 to 15/6	14/6 to 15/6	..	..
105,781	Brush Electrical Engineering, Ord., 1 to 105,781	2	Nil	Nil	Nil	¾— 1	¾— 1	..	..
150,000	Do. do. Non-cum. 6 % Pref.	2	3 %	6 %	6 %	¾— 1⅛	¾— 1⅛	..	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	96 — 99	96 — 99	..	..
*25,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	71 — 76	71 — 76	..	..
85,000	Callender's Cable Construction shares	5	20 %	15 %	12½%	9½— 10½	9½— 10½	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5¼— 5¾	5¼— 5¾	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	102 —106	101 —105	102	..
1,860,014	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	90 — 93	89 — 92	91½	90⅜
494,998	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	102 —105	102 —105	104½	102½
494,998	Do. do. Def. do.	Stock	4 %	4 %	4 %	79 — 82	79 — 82	81½	..
1,800,000	City and South London Railway	Stock	2 %	3½ %	2¾%	47 — 49	47 — 49	48⅝	47½
85,000	Crompton & Co., Nos. 1 to 85,000	8	7½%	5 %	..	1⅞— 2⅛	1⅞— 2⅛	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	95 — 98	94 — 97	..	..
99,361	Edison & Swan United Elec. Light, "A" shares, £8 paid, 1 to 99,361	5	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..
17,189	Do. do. "A" shares, 01—017,189	5	Nil	Nil	..	1 — 2	1 — 2	..	..
44,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	76 — 81	77 — 82	79½	..
100,000£	Do. do. 5 % 2n Deb. Stock Prov. Certs. all pd.	100	..	..	..	75 — 79	78 — 82	80	79½
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	4¼%	1⅝— 1⅞	1⅝— 1⅞	1⅞	..
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	..	..	..	2⅛— 2⅜	2⅛— 2⅜	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100	96 — 99 xd	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	9 — 9¼	9 — 9¼	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	98 — 98	98 — 98	..	..
200,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	15 %	11 — 12	11 — 12	11¼	11
200,000	Do. do. 4½ % Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	5 1/16	5
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	107 —111	107 —111	..	..
60,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	18½— 19½	18½— 19½	18⅝	..
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	100 —108	100 —108	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1½%	..	3⅞— 4	3⅞— 4	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10 — 10½	10 — 10½	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	20 %	36 — 39	36 — 39	38½	37
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	99 —102	99 —102	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3½%	3½%	89 — 92	89 — 92	91½	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (April 21st 1904).

SHARE LIST OF ELECTRICAL COMPANIES (continued).—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME,	Stock or Share.	Dividends for the last three years 1901.	1902.	1903.	Closing Quotations June 13th.	Closing Quotations July 20th.	Business done week ended July 20th, 1904. Highest.	Lowest.
100,000	Blackheath and Greenwich Dist. Electric Light, Ord...	‡	..	..	..	⅝ — ¾	⅝ — ¾	..	..
50,000	Do. 7 % Pref.	1	..	..	..	1⅛ — 1¼	1⅛ — 1¼	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs. ..	100	..	..	..	122 —127	100 —105	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	5	8 %	8 %	10 %	10¾ — 11¼	10¾ — 11¼	11	..
20,000	Do. do. 7 % Cum. Pref. ..	5	..	..	..	10¼ — 10¾	10½ — 10¾	10⅜	..
250,000	Central Electric Supply 4 % Guar. Deb. Stock	100	..	..	..	105 —108	105 —108	..	..
50,000	Charing Cross and Strand Electricity Supply	5	10 %	10 %	8 %	7⅛ — 8	7⅛ — 8	7 11/16	7⅛
70,000	Do. do. do. 4½% Cum. Pref. ..	5	..	..	..	5¼ — 5⅝	5⅛ — 5½	5 5/16	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref.	5	..	..	..	4¾ — 5	4¾ — 5	5 5/16	4 15/16
40,000	Do. do. 1908	5	..	..	..	4¾ — 5	4¾ — 5	..	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	102 —104	102 —104	103⅜	103
44,436	*Chelsea Electricity Supply, Ord.	5	4 %	4½%	5¼%	6¼ — 6⅝	6¼ — 6⅝	6 5/16	..
150,000‡	Do. do. % Deb. Stock Red.	Stock	..	..	..	106 —109	106 —109	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	10	5 %	5 %	5 %	11— 11½	10⅞ — 11¼ xd	11	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	..	..	..	13 — 14	13 — 14	..	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	120 —125	120 —125	..	..
800,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	101 —104	101 —104	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4 %	7¼ — 8¼	7¼ — 8¼	1 3/16	..
20,000	Do. do. do. 6 % Pref., 40,001—60,000..	10	..	..	..	11 — 12	11 — 12	10 6/8	10 6/8
400,000‡	Do. do. 4½% Deb. Stock	..	..	..	..	104 —107	105 —108	..	..
250,000	Do. do. 4½% 2nd Deb. Stock	Stock	..	..	..	100 —103	100 —103	..	..
50,000	Edmundson's Electricity Corporation, Ord. Shares	5	7 %	7 %	7 %	5¾ — 6⅛	6 — 6¼	6¼	6 3/16
80,000	Do. do. 6 % Cum. Pref.	..	..	..	..	5¾ — 6	5⅞ — 6	6 5/16	5⅞
140,000	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	107 —110	104 —107 xd	106½	..
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	12%	12 — 13	12 — 13	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	102 —105	102 —105	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	8	..	..	..	1¼ — 1⅜	1¼ — 1⅜	1⅜	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	4¼ — 4½	4¼ — 4½	..	..
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	94 — 97	94 — 95	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6½%	7½%	8½%	21 — 22	21 — 22	21¼	21¼
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid ..	5	..	..	..	5¼ — 5⅝	5¼ — 5⅝	5 7/16	5 5/16
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	108 —112	108 —112	..	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	96 — 99	96 — 99	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	6 %	13 — 14	12½ — 14½	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½ — 15½	14½ — 15½	..	..
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	..	..	..	8 — 9	8 — 9	8⅜	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	96 — 99	96 — 99	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	2½%	4 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..
60,000	Do. do. do. 4 % Deb. Stock	Stock	..	..	..	85 — 90	85 — 90	..	..
65,000	South London Electricity Supply, Ord.	5	..	1¾%	3 %	3⅜ — 4⅛	3⅜ — 4⅛	4 3/32	..
80,000	Urban Electric Supply, Ord.	5	..	..	..	4¼ — 5	4¼ — 5	..	..
80,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4¼ — 5	4¼ — 5	4⅜	4⅜
110,000	Westminster Electric Supply, Ord.	5	10½%	12 %	13½%	12¾ — 13¼	12¾ — 13¼	1 1/16	12 13/16
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6⅛ — 6⅜	6 — 6⅛ xd	6⅛	..

*Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, July 20th.

CHEMICALS, &c.	Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric .. .. .. per cwt.	5/-	..
a ,, Nitric .. .. per cwt.	22/-	..
a ,, Oxalic .. .. per cwt.	32/-	..
a ,, Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac, Sal .. .. .. per cwt.	42/-	..
a Ammonia, Muriate (crystal) .. per ton	£33 10	..
a ,, ,, ... per ton	£30	..
a Bleaching powder .. .. .. per ton	£4 10	..
a Bisulphide of Carbon .. .. per ton	£15	..
a Borax .. .. per ton	£18	..
a Benzole (90 %) .. .. .. per gal.	7/-	..
a ,, (50/90 %) .. .. .. per gal.	5/6	..
a Copper Sulphate .. .. .. per ton	£21 10	..
a Lead, Nitrate .. .. .. per ton	£24	..
a ,, White Sugar .. .. .. per ton	£31	..
a ,, Peroxide .. .. .. per ton	£27 10	..
a Methylated Spirit .. .. .. per gal.	2/6	..
a Naphtha, Solvent (90% a 160° C). per gal.	5/6	..
a Potash, Bichromate, in casks .. per lb.	3d.	..
a ,, Caustic (75/80%).. .. per ton	£24	..
a ,, Bisulphate .. .. per ton	£35	..
a Shellac .. .. per cwt.	200/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. per ton	£6 10	..
a ,, Recovered .. .. per ton	£5 10	..
a ,, Lump .. .. .. per ton	£5	..
a Soda, Caustic (white 70 %) .. per ton	£10 15	..
a ,, Crystals .. .. .. per ton	£3	..
a ,, Bichromate, casks.. .. per lb.	2½d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£130	..
b ,, Wire, in ton lots .. per ton	£168	..
b ,, Sheet, in ton lots .. per ton	£166	..
p Babbitt's metal ingots .. .. per ton	£48 to £130	..
c Brass (rolled metal 2" to 12") basis per lb.	6½d.	..
c ,, Tube (brazed) .. .. per lb.	8⅛d.	..
c ,, ,, (solid drawn).. .. per lb.	7¼d.	..
c ,, Wire, basis.. .. .. per lb.	6¾d.	..
c Copper Tubes (brazed) .. .. per lb.	9½d.	..
c ,, ,, (solid drawn) .. per lb.	9¼d.	..
a Copper Bars (best selected .. per ton	£70	..

METALS, &c. (continued).	Latest Price.	Week's Dec. or Inc.
g Copper Sheet .. .. .. per ton	£70	..
g ,, Rod .. .. per ton	£70	..
e ,, (Electrolytic) Bars .. per ton	£62	..
e ,, ,, Sheets .. per ton	£78	..
e ,, ,, Rod .. per ton	£72	..
e ,, ,, H.C. Wire per lb.	7¾d.	..
f Ebonite Rod .. .. .. per lb.	3/8	..
f ,, Sheet .. .. .. per lb.	8/-	..
n German Silver Wire .. .. per lb.	1/6	..
h Gutta-percha fine .. .. .. per lb.	8/-	..
h India-rubber, Para fine .. .. per lb.	4/9½ to 4/10½	..
i Iron, Charcoal Sheets .. .. per ton	£18	..
i ,, Pig (Cleveland warrants) per ton	42/6	..
i ,, Forgings, according to size per ton	From £11	..
i ,, Scrap, heavy .. .. per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 .. per ton	£9 15	..
g Lead, English Ingot .. .. per ton	£11 17 6	..
g ,, ,, Sheet .. .. per ton	£11 17s. 6d.	..
m Manganin Wire No. 28 .. .. per lb.	8/-	..
g Mercury .. .. per bot.	£7 17 6	..
d Mica (in original cases) small .. per lb.	6d. to 1/	..
d ,, ,, ,, medium per lb.	2/6 to 4/-	..
d ,, ,, ,, large .. per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings per lb.	1/- to 1/2½	..
p ,, rolled bars & rods per lb.	1/- to 1/3	..
p ,, ,, strip & sheet per lb.	From 1/1	..
o Platinum .. .. per oz.	£4	..
c Silicium Bronze Wire .. .. per lb.	9d. to 11d.	..
i Steel, Magnet, acc'd'g to desc'p'n per ton	£58	..
i ,, ,, in bars	£15 to £40	..
g Tin, Block .. .. per ton	£121 10 to £122 10	10s. inc.
g ,, Foil .. .. per lb.	1/6	..
m ,, Wire, Nos. 1 to 16 .. .. per lb.	1/6½	..
p White Anti-friction Metals— "White Ant" brand .. per ton	£42 to £62	..
j Yarns, 2/10s Grey Cotton, on sp'ls per lb.	8d.	..
j ,, 6 lea. Flax .. .. .. per lb.	5½d.	..
j ,, 3 ply 10 lbs. Russian .. per lb.	4 11/16d.	..
j ,, 10 lbs. Russian, single .. per lb.	4½d.	..
j ,, 180 lbs. Jute rove .. per ton	£11	..
k Zinc, Sh't's (Vieille Montagne bnd.) per ton	£25 5	10s. inc.

Quotations supplied by Messrs.:—a G. Boor & Co.; b The British Aluminium Co., Ltd.; c Thos. Bolton & Sons., Ltd.; d F. Wiggins & Sons.; e Frederick Smith & Co., f India-Rubber, G.P. and Teleg. Works Co., Ltd.; g James & Shakspeare; h Edward Till & Co.; i Bolling & Lowe; j Walter H. Hindley and Co., Ltd.; k Morris Ashby, Ltd.; m W. T. Glover & Co., Ltd.; n P. Ormiston & Sons; o Johnson, Matthey & Co., Ltd.; p The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Aberdeen	July 2	1,417	+ 60	5	7,468	+ 1,217	10	—
Bath	,, 18	745	—	29	16,488	—	12½	—
Birmingham ..	,, 16	5,771	+592	29	155,794	+10,036	8¾	—
Blackburn	,, 15	1,087	+216	16	15,450	+ 1,310	13½	—
Blackpool	,, 14	1,419	+ 64	15	18,970	+ 726	8½	—
,, —Fleetw'd	,, 16	964	—160	2	2,100	— 345	7½	—
,, —Lytham	,, 14	651	+106	27	9,954	+ 5,873	7½	—
Bolton	,, 17	2,034	+103	16	29,908	+ 55	25	—
Bournemouth ..	,, 13	1,266	+160	15	16,524	—	10½	—
Bradford	,, 9	4,979	+1100	14	65,974	+11,316	50	—
Brighton	,, 17	1,218	+231	—	15,068	—	9	—
Bristol	,, 15	5.645	+269	—	—	—	23	—
Devonport ..	,, 8	630	+123	27	18,854	+ 2,262	5	—
Dudley—Sto'rb'ge	,, 8	975	+ 91	27	22,300	+ 778	18½	—
Gateshead ..	,, 8	912	+ 40	27	24,046	+ 1,094	10½	+ ½
Gr'n'k—Pt. Glsgw	,, 8	741	+101	27	14,549	+ 680	7½	—
Oldham—Ashton	,, 8	569	— 21	27	14,475	— 826	8	—
Potteries	,, 8	1,763	+296	27	45,628	+ 3,747	28½	—
South Staffs. ..	,, 8	725	—250	27	20,857	— 1,749	21½	—½
Swansea	,, 8	545	— 1	27	13,848	+ 796	5½	—
Wolverhampton..	,, 8	396	— 37	27	10,181	— 240	10½	+8
Yorks. Wool Dist.	,, 8	651	+279	27	15,615	+ 6,699	6	—
Miscellaneous ..	,, 8	4,496	—	27	87,411	—	—	—
Burnley	,, 16	1,263	+328	—	—	—	10½	+3½
Burton-on-Trent ..	,, 10	387	—	14½	5,000	—	8½	—
Cardiff	,, 9	2,186	—413	14	29,619	— 624	14	—
Chatham & District	,, 14	721	+ 55	28	15,954	+ 2,082	9·53	—
Cork	,, 14	612	— 68	28	12.605	— 1,055	9	—
Dover	,, 16	290	+ 25	28	5,659	— 313	5½	—

Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Dublin	July 15	5,528	+270	—	11,585	— 21	47	+ ½
East Ham	,, 16	804	+ 85	15	11,836	+ 1 087	5	+ ½
Glasgow	,, 16	15,109	+1543	7	98,563	+ 2,034	71½	+6½
Halifax (2 weeks) ..	,, 13	3,495	+447	15	23,006	+ 1,594	33	+1½
Huddersfield ..	,, 16	1,424	+ 99	15	—	—	28	—
Hull	,, 16	2,268	+394	15	32,868	+ 3,970	13	+2½
Ilkeston	,, 13	160	— 47	15	2,230	—	3·5	—
Ipswich	,, 16	621	—	15	7,778	—	10 ½	—
Isle of Thanet ..	,, 16	1,321	+ 43	28	13,634	— 329	10½	—
Leeds	,, 16	6,400	+690	—	94,168	+ 5,860	81½	+2
Liverpool	,, 9	11,199	+ 597	28	281,454	+ 6,404	103	—
London C. C. ..	,, 9	14,117	+2930	14	171,048	+29.081	39½	—
Manchester	,, 16	13,486	+1417	15	186,521	+ 6,126	131½	—
Newcastle	,, 16	4,149	+862	—	—	—	17	—
Portsmouth	,, 16	2,567	+366	—	31,136	+ 2,685	14½	—
Salford	,, 11	4,451	+308	—	60,274	+ 4,996	30	—
Sheffield	,, 17	4,902	+418	16	76,386	+ 2,511	33	+5½
Southampton ..	,, 14	1,080	—103	—	—	—	9	—
Southend-on-Sea ..	,, 13	506	+ 59	15	5,154	+ 433	6½	—
Sunderland	June 26	1,361	— 44	12	15,630	+ 343	20	+1
Tyneside	July 13	479	+ 75	28	10,362	+ 1,859	8·9	+ ·4
West Ham	,, 14	1,149	—	20	15,479	—	8	—
Wolverhampton ..	,, 13	844	+262	—	—	—	9·5	—
Cen. London Rly. ..	,, 16	6,282	—315	2	12,646	— 825	6	—
City & S. Lon. Rly.	,, 17	2,272	—218	3	7,119	— 299	6½	—
Dublin—Lucan Rly.	,, 15	144	+ 19	2	305	+ 85	6½	—
G. N. and City Ry.	,, 16	959	— 9	22	20,388	—	3½	—
L'pool Overh'd Rly.	,, 18	1,722	— 20	3	5,083	— 49	6½	+4½
Mersey Railway ..	,, 16	1,384	+ 24	2	2,813	+ 61	4½	—

* Compared with the corresponding period of 1903.

THE MUNICIPAL ELECTRICAL CONVENTION.

POLYPHASE SUB-STATIONS: THEIR EQUIPMENT AND WORKING.

By S. L. Pearce, Chief Electrical Engineer, Manchester.

(Abstract of paper read at Nottingham, June 30th.)

(Concluded from page 116.)

Examples of Motor-Generator Equipments.—Figs. 5 and 6 show two typical equipments for the sub-stations of the Manchester Corporation. The Polygon* is one of 10 stations, the general design in each case being the same, although the size and arrangement are modified to suit local conditions. The building is divided into two bays, the larger containing at one end the traction motor-generators, also the separate high and low-tension switchboards. At the other end are placed similarly the lighting motor-generators and balancing sets, and the corresponding high and low-tension switchboards. In the second bay provision is made for extension sets.

Each traction set consists of a synchronous motor operating direct at 6,500 volts, and coupled to a 220-kw. continuous-current compound-wound generator, the exciting current for the motor field being obtained from an exciter mounted on an extension of the shaft, or, as an alternative, from the lighting bus-bars.

Each lighting set similarly consists of a synchronous motor direct coupled to a 220-kw. continuous-current shunt wound generator to give 420 to 430 volts across the outers of a three-wire system, and they are also so arranged as to give 210 volts on either side of the middle wire. The exciting current for the motor is taken from the terminals of the low tension generator, or as an alternative from the lighting bus-bars.

The balancing sets, one of which is provided in each sub-station, consist of a 125-kw. three-phase induction motor direct-coupled to two 52-kw. continuous current shunt wound generators, placed one at each end of the motor shaft, supplying current at about 205 volts.

Two high tension switchboards are placed on galleries, one at each end of the main bay, and two low tension switchboards are placed on galleries along the front side of the main bay, both being used for traction and lighting respectively. Means are provided for interconnecting the bus-bars of the two boards, so that traction sets can be run from lighting feeders, and *vice versâ*.

The high tension cable work in the station is almost entirely three-core, armoured throughout.

The second type of sub-station is represented by "Oldham Road," which is typical of the second 10 stations; with the exception of two, all are arranged for both lighting and traction. Each station is arranged in one bay, with the high tension switchboards on one side, and the low tension on the opposite side, the machines being placed in pairs down the centre, provision being left at one end for considerable extensions. The equipment, consisting of synchronous and induction motor-generators, is very similar to the previous type, their outputs varying from 250 kw. to 104 kw. The low tension generators of each set are, however, compound wound, and are therefore available for either lighting or traction purposes.

The main switchboards are placed on galleries 9 ft. above floor level. The high tension board controls the incoming and outgoing feeders, and the synchronous motors, and is provided with two sets of bus-bars, to which the lighting and traction feeders are respectively connected. But as each motor is provided with a change-over switch, and can therefore be run off either set of bars, the arrangement is practically equivalent to a "duplicate set." Frequently lighting and traction sets are run off the same bus-bars, and the varying load of the latter has not been found to interfere with a steady voltage being obtained from the former. This would appear to raise the question as to whether separate lighting and traction bus-bars are really a necessity. Under the main gallery and on the floor level are placed the various resistances, starters, and feeder chargers, the latter consisting of three separate water tanks, forming a non-inductive resistance. This arrangement has been found preferable in every way to the choking coil or separate motor-generator type.

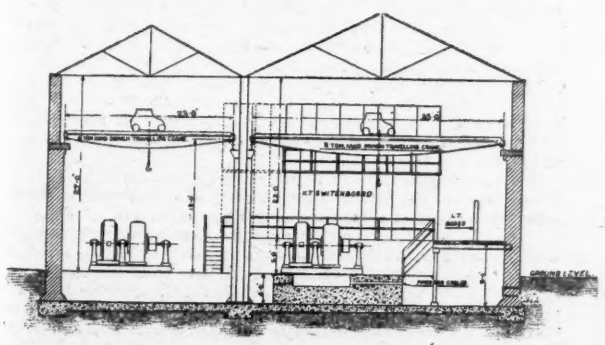


Fig. 5.

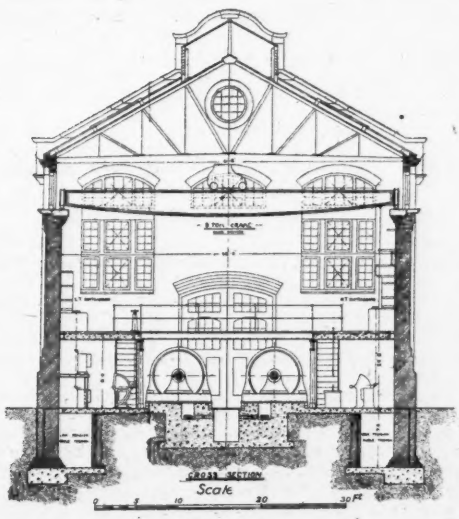


Fig. 6.

Static Transformer Equipments.—In a sub-station recently equipped for Beyer Peacock & Co., Gorton, Manchester, the transformers are of 60-kw. capacity, six of these being banked together in "mesh" to form two groups of 180 kw. each. The ratio of voltage is 6,500 : 220. They are of the natural ventilation type. The switchboard is of the multi-frame order. The current is metered on the primary side of the transformers, and a recorder is fixed on the low tension panels reading direct in horse-powers. Provision is made for extension, the above instalment representing rather more than one-third of the capacity of the works. The efficiency of the transformers has been guaranteed 98·5 per cent. at full load, with a drop of not more than 4 per cent. when working on any power factor.

Working of Sub-Stations.—Starting Up.

Rotary Converters.—There are three possible ways of starting up a rotary converter. (1) From the alternating current side by switching it straight on to the supply lines. This method was adopted, and, as far as the author knows, is still in vogue on the Central London Railway system, and on the Liverpool and Southport line, in the case of the first rotary to be started up each day. It is necessary to have a field-splitting switch in order that the shunt windings may be opened before starting, otherwise they would break down owing to the excessive E.M.F. induced at the moment of closing the A.C. main switch. Further, if the rotary be compound wound, the series field windings must be open-circuited. All switches on the direct current side must be left open before switching the rotary on to the line. By reason of the hysteresis lag in the poles, and in a lesser degree due to the eddy currents set up, the rotary will start as soon as the alternating current switch is closed, and will immediately run up to synchronous speed. As soon as synchronism is attained, the field-splitting switch and direct current field switch can be closed. With self-exciting sets care must be taken to see that the latter is closed as the machine is building up on the right polarity, which can be done by closely observing the direct current voltmeter. If this is not done, the polarity on the direct current side of the rotary will be reversed.

The rotary will now be running in synchronism with the main generators, and can be paralleled on the low tension bus-bars in the usual way. Although this method may be unavoidable in some cases, it has serious disadvantages, chiefly on account of the large current at low power factor which it draws from the supply lines, and the possibility of the rotary building up on the wrong polarity. For traction work this method may be employed, but not for lighting purposes.

2. Starting up from the direct current side is a far simpler process; it presents no difficulties of operation, and can usually be followed in most instances where a supply of direct current in the sub-station is available. In the case of the Central London Railway this method was always adopted for all sets after the first. For lighting systems the starting current required for large units might occasion a heavy drop on the distributing mains, and it will become necessary either to provide an induction motor-generator set to supply the necessary direct current, or, better still, the following method may be usefully employed.

3. This consists in coupling on to an extension of the rotary shaft a small three-phase low-pressure induction motor, the capacity of which should be approximately one-tenth of the full load output of the rotary. By means of this starting motor, the whole set may be brought up to synchronous speed, the alternating current and direct current fields adjusted, and the alternating current side of the rotary synchronised on to the line, afterwards cutting out the starting auxiliary unit.

The starting up of synchronous motor sets presents no difficulties, and is usually done from the direct current bus-bars, synchronising

* See illustrations in the Elec. Rev. for July 3rd, 1903.

on the alternating current side in the usual manner. It is, however, absolutely necessary that provision be made in every sub-station for the plant to be started up from the alternating current side in the event of a possible shut-down of the lighting or traction systems. Such means are to hand in the employment of induction motor sets, which in lighting sub-stations are frequently coupled up to the balancers. Their value in this respect forms a reason, in addition to those previously set forth, why a combination of induction and synchronous motor sets is desirable. If battery power is available, this will provide the alternative direct current supply, but it rarely happens that battery stations and polyphase sub-stations are combined.

A method of starting up applicable to both rotaries and synchronous motor-generators is shown in fig. 7, and is a slight modification of the first method described for the starting up of the former.

The compensator shown reduces the primary voltage to one half; the double-throw oil switch, which is fitted with an over-load device, is thrown down on to the bottom contacts. Half voltage is thus impressed on the rotary or synchronous motor, and the field switch being left open, the machine runs up on an induced field. When full speed is attained, and the field built up in the right direction, the field switch is closed, the oil switch is thrown over on to the top contacts, *i e*, on to the full voltage bars, and the starting high-tension oil switch is withdrawn.

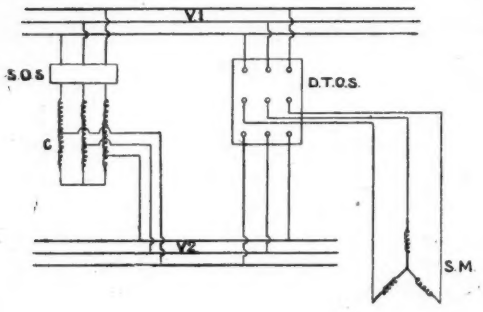


FIG. 7.

The motor-generator with induction motor is the simplest of al types of sub-station equipment to start up. With long feeders it is desirable that the pressure on the feeders should be applied gradually to the stator of the induction motor, as any throw-up in the voltage due to the capacity of the feeder at the moment of switching-in might break down the insulation of the motor. A suitable design of three-phase stator starter consists of three coils arranged in a triangle, and carefully insulated by cylinders of mica. Each coil is provided with an adjustable core consisting of a large number of iron sheets $\frac{1}{50}$ in. thick The three iron cores are attached to a round disk, which is held by a three-armed cast-iron holder, through the middle of which runs a screw, and the three iron cores can thereby be raised and lowered. The three coils are switched in series with the corresponding phases of the motor which is to be started up.

Before switching in, the iron cores are lowered into the coils so that on first switching in only a small current goes into the stator of the motor. The cores are then gradually raised out of the coils, the inductive resistance being thereby gradually lessened, and finally the coils are short-circuited. A water resistance or other suitable form of starter is inserted between the slip-rings of the rotor, and short-circuited as soon as the set is up to speed, when the machine can be paralleled in the usual manner on the direct current side.

On account of the heavy rotor cables with large units, it is desirable, to avoid expense, that the rotor starter should be placed as near the machine as possible, and a convenient arrangement is to operate it by means of bevel gearing from the front of the switchboard platform.

Exciting.—Rotaries are invariably self-excited, for obvious reasons. There is one strong disadvantage, however, with this method, consequent on the possibility of the rotary reversing whilst under load. This happened on two or three occasions on the Central London Railway system, and is a possibility to be reckoned with. If the rotaries are excited from the bus-bars, then a battery connected across the bars becomes imperative.

For synchronous sets employed on traction circuits, a separate exciter mounted on the end of the shaft is probably the best method of exciting the high-tension motor fields. Although it occupies extra space, it provides an alternative method of excitation from the lighting bus-bars where a mixed system is supplied. In any case it is desirable that the excitation for the traction sets should be independent of the lighting system, and this can best be obtained by the use of a separate exciter, or a method to be described later on under "Balancing." For synchronous sets on lighting networks, excitation from the D.C. terminals or L.T. bus-bars will probably be found sufficient. The author considers that the question of excitation is of importance, and should be well considered.

Balancing.—The effective balancing of a three-wire lighting network from sub-stations can be secured by the use of an induction motor coupled to two generators giving about half the pressure across the outers, the whole combination forming an auxiliary set for the supply of direct current necessary to start the larger synchronous units.

It is, however, desirable that additional means of balancing should be provided, either by the use of double-wound armatures with the synchronous sets, or other methods. An alternative arrangement has been used extensively in the Manchester sub-stations, and emanates from the Allgemeine Co. This apparatus is essentially a choking coil, the ends of which are connected up by means of two slip-rings to the armature of the continuous current dynamo. The slip rings are connected up to the armature at such points that a normal alternating current at the frequency corresponding to the number of pole-pieces and the revolutions is circulating in the equaliser. The middle wire of the system is connected up to the middle point of the choking coil. If the load on each of the two net-halves is unequal, the overload on one will pass through the middle wire into the respective side of the equaliser, and through the slip-ring belonging to it back into the armature. This method also provides another supply for exciting current, and if all the synchronous plant in each sub-station is so arranged, it is evident that each set will be self-excited. An out-of-balance current up to 25 per cent. can be dealt with under this arrangement without the difference in voltage exceeding 2½ per cent. of the mean voltage.

Hunting.—To ensure satisfactory parallel running and immunity from "hunting," it is necessary that every detail of the system should be very carefully considered. Troubles from this source are almost entirely associated with rotary equipments. This trouble can be set up independently of the power house engines. Oscillations may be set up from a variety of causes within the rotaries themselves, which, if not checked, will spread over the whole system. It is necessary, therefore, in the first place, to provide suitably, but not too well governed, engines in the power house; and secondly, to attach special devices to the rotaries themselves to check any oscillations that may be set up. For this purpose "damping coils" are used, which usually take the form of copper plates which bridge over the space between the pole tips. The eddy currents produced in the latter tend to restrain or counteract the distortion of the magnetic field due to the armature oscillations.

This tendency to instability of rotaries, however inappreciable for traction work, has placed them at a disadvantage for lighting work. With synchronous machines the author has never experienced any trouble from this source.

Synchronising.—It is of greater importance that the machine should be as nearly as possible in phase than at the same voltage. A synchroniser so arranged as to indicate the relative speeds of the incoming machine and those already on the load will be found a useful and time-saving device, and may be combined with the ordinary method of voltmeter and lamps. By the adoption of this type of synchroniser the machine can be synchronised in the shortest possible time, and with the smallest interchange of current between the various machines.

General Conclusions.—The majority of sub-stations are required for one or other of the following purposes:—(1) Traction; (2) Mixed lighting and traction; (3) Direct-current lighting and power.

For the first of these very strong reasons must exist if the claims of the rotary converter operating at 25 cycles are overlooked. They are at least 5 per cent. more efficient than either of the other equipments; their ability to stand considerable over-loads, and the high power factor at which they can be operated, outweigh the disadvantages pointed out in the earlier part of this paper.

For the second of the above purposes, lighting considerations will probably settle the type of equipment, and for this synchronous motor-generators operating at 50 cycles appear to best fulfil the majority of the conditions required, viz., ease of regulation of direct-current pressure, satisfactory parallel running, little or no variations in pressure; in short they are not so sensitive as rotaries, and they can also be worked at an equally high power factor. It is possible that the disadvantages of the rotary are sometimes exaggerated. Their large use in the States and increasing use in this country point to the fact that under special circumstances their adoption may be deemed warranted.

The third class is the one in which, perhaps, most difficulty will be experienced in deciding on the respective merits of synchronous *v.* induction motors. As mentioned before, the drawback to the latter is the fact that the current is always a lagging current, and the smaller sizes have a relatively low power factor. There is also a gain of 1 to 2 per cent. in efficiency in favour of the synchronous type, to balance which may be placed the extra complications in switchgear. For units of 500 KW. and over the author considers that either type might be usefully employed, the increased cost of the induction type being balanced by the increased cost of switchgear with the synchronous type. For units of less than the above output, a combination of both types has worked with advantage, the leading currents of the one compensating for the lagging currents of the other, while the induction motors provide the necessary means of starting up the sub-station from the high-tension side in the event of failure on the direct-current side of the system.

MR. RUTHVEN MURRAY, who opened the discussion, expressed his surprise that the fable of trouble with rotary converters was still in existence. From his own experience they were almost perfect machines, even for lighting work. He thought the author slighted two-phase plant to some extent—it was not so heavy for similar outputs as three-phase. He then described the practice at Willesden, where a regulation of 50 per cent. was obtained on the D.C. side, and the balancing of the rotaries was performed on the three-wire continuous-current system. It was useful at times

to have the transformers connected up as primary, star connection, secondary, mesh connection It was also not necessary to have the rotaries operating at such a low frequency as 25; on the North Metropolitan tramway they were using 50 cycles, as used on the Isle of Thanet tramways for some years. He thought that the advantages of a direct supply of polyphase current were rather overstated—a method of regulating voltage was a necessity for the consumer, and extra expense would be incurred by the additional apparatus. The gradual increase in the number of transformers in use would also diminish the efficiency of the system in time. Hunting troubles in rotaries, he believed, would vanish with the increasing use of steam turbines for generating purposes.

Mr. S. Z. DE FERRANTI commented on the tendency to great complication which characterised electrical engineering of to-day. He believed we should eventually return to simple alternating current, or adopt a much simpler system of transformation. He commended his hearers to a search for a cheaper, simpler, and more general system of supply of electricity, more comparable with gas lighting methods, which, at the present time, offered an exceedingly severe competition. As a constant advocate of the single-phase alternating system of supply, he noted the great advance which had been made in single-phase motors, which, he believed, would successfully operate traction and power systems in the near future.

Mr. C. H. WORDINGHAM believed that the prejudice against the rotary was fast breaking down, and they appeared to be justified in adopting them from considerations of efficiency and cost. On the question of frequency, which had been discussed by the Standardising Committee, it was no use recommending a particular frequency, unless acceptable to the user. He disagreed with the author's practice in not placing reverse current circuit-breakers on the feeders at the sub-stations, as a failure of one feeder might cut out the sub-station.

Mr. J. S. HIGHFIELD commented on the diverse frequencies in use in Great Britain. The large sub-station systems introduced numerous complications and possible breakdowns, and he emphasised the need for reliability, which entailed simpler methods than at present in use.

Mr. A. E. HADLEY recommended the adoption of 50-cycle alternating current systems, with asynchronous motor-generators in the sub-stations, for simplicity and cheapness. Single-phase traction was making rapid strides, and several railways and tramways of that type were running.

Mr. J. H. RIDER emphasised the necessity for reliability in the first place in any system. Rotary machinery was a necessity where alternating current had to be transformed to direct current; it was the weak link which required strengthening. A slight hitch might shut down a sub-station, and some minutes would elapse before it was started again, this being a serious matter in a tramway system like the L.C.C.'s; in contrast to this he cited the Glasgow induction machines, which would be comparatively unaffected under similar circumstances. He advocated the discarding of fuses, and the unreserved use of switch controlling gear; referred to the great benefits of the L.T. synchronoscope for synchronising, and expressed his disbelief in the necessity of cable charging.

Mr. PEARCE, in reply, discounted the use of 25 cycles for lighting purposes, although for traction it gave a better compounding effect. The question of frequency had such a bearing on the first cost of apparatus, that it had to be settled in the beginning, before the plant was arranged. In his experience, the expense of putting on the reverse-current circuit breakers, mentioned by Mr. Wordingham, was not warranted. At Manchester they had had to shut down a large proportion of their induction plant, owing to its noisy running. In reply to Mr. V. A. H. McCowen, he stated that the overall efficiency of the sub-stations was 75 to 76 per cent.; the capacity of the machines, however, was somewhat small.

THE FINANCIAL POSITION OF MUNICIPAL ELECTRICAL UNDERTAKINGS.

By Clr. H. J. BLAKEWAY, Chairman of the Electricity Committee, Southampton.

(*Abstract of Paper read at Sheffield on July 1st, 1904.*)

FROM the returns of 155 municipal undertakings the author finds that the total capital expended is £21,983,000, and he asks, "How much of this is at the present date productive?" The gross profit of these concerns amount to £1,333,000, or 6 per cent. on the capital employed. Interest and sinking fund amount to about 5½ per cent. After meeting these charges, 63 towns have a deficit and 92 a surplus, and deducting the former from the latter, the net result is a surplus of £197,707 on the year's working, or 0·9 per cent. on the capital outlaid. Coal was then at a fairly low price; it was not pleasant to think what the results would have been had it reached the figures of two or three years ago. On a capital, therefore, of nearly 22 millions, some of which was practically dead, there was a sum of under 1 per cent. which could be devoted to a depreciation or renewals fund. How many of them had such a fund; and was the necessity of having one generally realised?

The author omitted from his calculations a grant to the local rates, as in his opinion, before any of the surplus could be used for this purpose, "current for lighting must be sold at the lowest possible rate," and the renewals fund must stand at a substantial figure.

The main object of their undertakings was to supply current for lighting purposes at as low a rate as possible; in many cases traction and power were catered for at too low rates, and a financial loss incurred thereby. The author considered that the price to be charged for traction should be computed by adding to the total costs such capital charges as could be fairly allocated to the traction load, plus depreciation and renewals, but without profit. The author believed that, in the majority of instances, current for power purposes was also sold below cost, without benefiting the station financially. This was almost immoral; many stations were actually selling current to the public for power, at a lower rate than was charged to the tramways. One or other rate must be wrong, even allowing for the power supply being taken from the existing lighting mains, while extra mains were put in for traction purposes. By what process of reasoning were these power units to be exempted from bearing their proper share of the station expenses and capital charges?

Somebody had to pay; and if the power consumers were exempted, the lighting consumers, who were the mainstay and deserving of every reduction and consideration, had ultimately to suffer. If there was a loss, as there was in 63 out of 155 installations, the general body of ratepayers might be actually called upon to contribute to the working expenses of the industries of the district, a state of affairs which they should not tolerate.

Public lighting was a load as productive and profitable as any that could be had; but why did so many stations handicap themselves by charging a higher rate than for power? Where the local body had an electrical supply, it should have the greater part of the street lighting, at a price not more than that for traction and power.

Unless they were all careful and prudent, they would find their capital expenditure grow beyond a remunerative point. "We shall also, in the more or less near future, have to face within the periods of our borrowing powers heavy renewals, and the points raised in this paper are crystallised in the question, *Will our present and prospective revenues on their present basis meet the demand?*"

In the discussion which followed Councillor Blakeway's paper the author's figures and deductions came in for unfavourable comment all round.

Dr. PANTON (Bolton) in criticising the figures, pointed out that it was unfair to expect an undertaking to show a profit in its first year of operation; the figures for capital expended also included 3½ millions brought in during the year, which was unproductive, and if allowed for, would raise the profit to 6·6 per cent. He also emphasised the fact that municipalities did not endeavour to make large profits—they endeavoured to meet their financial obligations only.

Bailie WILLOCK (Glasgow) pointed out that the average price obtained was the main point to consider in connection with the charges to consumers.

Alderman BRUCE (Sunderland) agreed that the author's figures were misleading, and suggested that in addition to allowances for the first and second years of working, such should be made when large extensions were in hand. The basis for charges should be the consumer's load factor.

Alderman PEARSON (Bristol) pointed out that electricity departments were largely the victims of circumstances, such as coal prices, &c., but gas companies also suffered in the same way. He regarded the sinking fund as a provision for depreciation, but agreed that a reserve fund was required to meet accidents, while renewals should be provided for out of sinking fund.

Alderman IVEY (West Ham) considered that a policy of raising prices would be fatal to the concern; and

Alderman SMITH (Barrow) commented on the fact that the position of the undertakings was more secure than was usually supposed.

Councillor BLAKEWAY deferred his reply.

THE LOCALISATION OF "EARTHS" ON FEEDERS AND NETWORKS.

By HORACE BOOT,

Consulting and Resident Engineer to the Tunbridge Wells Corporation.

FROM time to time different articles have appeared in the various technical journals relating to the localisation of "earths," but up to the present, no articles have been written giving data of actual tests and results obtained from such tests in the localisation of faults.

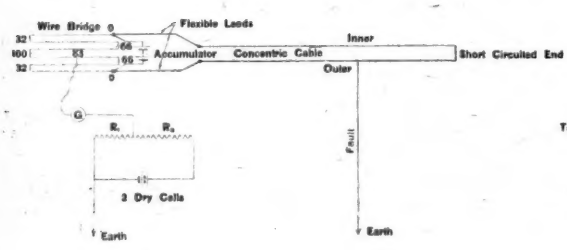
As far back as 1893, various authors and cable engineers suggested methods more or less satisfactory, such as:—Waiting until the "still of night," and wheeling a large induction coil with a telephone receiver attached, over the line of cable. The author had adopted this method himself, and rarely was he successful in getting the fault nearer than 30 or 40 yards, and then with considerable uncertainty; it has usually resulted in the old "barbaric" method of "cut and try," and, finally, when the length has been reduced to a reasonable one, laying a new piece of cable and re-jointing. This is a very expensive method, quite unsuitable and

unnecessary to-day, although it is to some extent still practised by certain cable companies.

The author has tried various other methods, with modifications of the loop test and the "bridge," but has, for some time past, secured considerable success by adopting the method described below and found by his experience to be the best one. It is a perfectly simple method, and requires only the following apparatus, most of which can be manufactured for the occasion :—

1. A wire bridge divided off into 200 parts.
2. A two-cell accumulator capable of giving about 20 amperes discharge.
3. A sensitive pocket galvanometer of the D'Arsonval type, having a needle instead of the mirror.
4. A small regulating resistance with battery to neutralise earth currents, and thus retain the sensitiveness of the galvanometer, although this could be avoided if it were

FIG. 1.



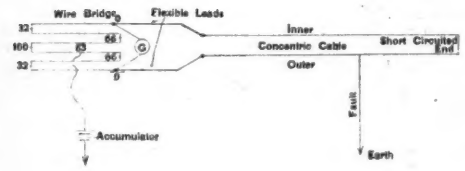


FIG. 2.

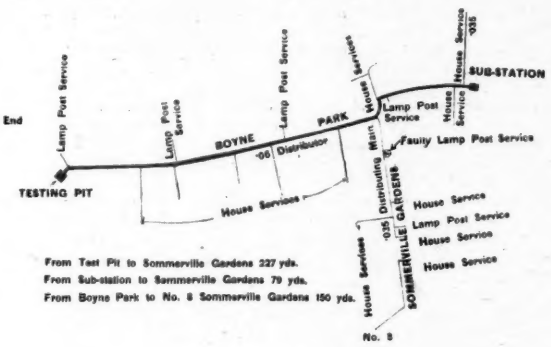
fault on a most complicated network of concentric cables, after the experience he has had in localising earths.

In fig. 1 is shown a sketch of the connections employed to find the faults enumerated below, from which it will be seen that a wire bridge divided up into 200 parts is employed. The object in taking 200 parts, is in order to obtain a direct percentage reading, and thus avoid calculations, which, if undertaken by the ordinary mains foreman, might involve errors.

It is necessary for the flexible leads in fig. 1 to be of the same sectional area as the cable which is being tested ; if not, allowance must be made for the length from the point of the bridge, otherwise an error will result.

By using the accumulator connected up in the method shown in fig. 1, a heavy current is sent round the cable, through the short-circuited end, and the resistance of the fault does not matter, because the galvanometer is connected

FIG 3.



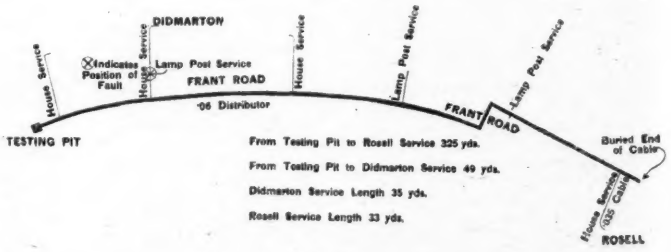


FIG. 4.

desired, by arranging for the needle to be re-adjusted to zero, to balance the E.M.F. of the earth. This, as it reduces the sensitiveness of the galvanometer, is a disadvantage for very accurate testing.

The whole outfit need not cost many pounds, the galvanometer being the most expensive item. The wire bridge can be easily made at home, and it is found most suitable when it has a resistance of something like half an ohm. It is possible by altering the connections to do away with the neutralising battery, but experience has shown the author that the results obtained are not so accurate when connected up in the method indicated in fig. 2, as when the method adopted for carrying out the tests is as shown in fig. 1.

It is interesting here to recall the remarks made by Mr. C. H. Wordingham in the discussion on Mr. Quin's paper on "The Localisation of Faults in Underground Mains," in 1897, which were as follows :—

Mr. Wordingham "must confess to be a little sceptical about fault-finding being a scientific occupation. His own experience was that the best testing apparatus was 3,000 or 4,000 H.P., the best indicator was a column of smoke, and the most useful instruments were a pick and shovel. When all was said and done it generally came down to that, if they had a large network which was much connected up."

This gives one some idea of the opinions held by certain engineers with respect to fault finding ; but the author is convinced that such a drastic and costly remedy is quite unnecessary, and he would be willing to find any reasonable

across the same, and only requires a very small shunt current to deflect it.

The trouble experienced in getting a satisfactory reading with this method of connection, was the difficulty of neutralising the earth currents, without reducing the sensitiveness of the galvanometer, and this the author has entirely overcome by arranging a resistance, R_1 and R_2, connected across a couple or more cells, one end being connected to earth, and balancing the E.M.F. of the earth until no deflection is obtained on the galvanometer ; then, on sending a current from the accumulators round the cable and moving the galvanometer contact along the wire bridge until no deflection is obtained, it is only necessary to read off the figure and take the percentage of the total length of cable, from which the distance of the fault along the cable can be obtained.

In figs. 3 and 4, sketches of actual faults located are given, showing the complicated sections with house services and branch distributors. The author has found that the more services he has on the distributor, the easier it is to locate the position of the fault, because it gives an opportunity of short-circuiting the cable at many points. Fig. 2 shows the bridge in use with the accumulator connected to earth, and the galvanometer across the two ratios of the bridge. This method of connection has the objection that a number of cells are required if the fault is of high resistance, and it is found that the galvanometer is nothing like so sensitive, nor can the calculations be made within a few feet, as is possible with the other method, provided the E.M.F. of the earth currents be neutralised.

The following are some of the results obtained, most of them being on rather complicated networks :—

Fault.	Length of concentric cable.	Calculated distance of fault.	Actual distance.
Goods Station Road, 5-amp. twin cable with services.	800 yds.	247 yds.	246 yds.
Broadwater Down, ·06 concentric distributor with services.	460 yds.	375 yds.	374 yds.
Boyne Park network, ·06 and ·035 distributor.	306 yds. with branch, 221 yds. long.	272 yds.	267 yds.
Mount Ephraim, ·06 distributor with services.	485 yds.	385 yds.	385 yds.
Broadwater Cross, ·06 distributor with services.	427 yds.	228 yds.	224 yds.
Woodbury Park Road, ·06 distributor with services.	360 yds.	205 yds.	207 yds.
London Road, ·06 distributor with services.	305 yds.	101 yds.	100 yds.
Frant Road, ·06 and ·035 distributor with services.	361 yds.	45 yds. along the main, 7½ yds. along the service.	45 yds. along main, 8 yds. along the service.
Warwick Park, ·06 distributor with services and branches.	227 yds.	59 yds.	From 53 to 64 yds. off, the insulation was found in very bad state due to moisture.

In calculating the distance of a fault, where the sectional area of the cable varies, allowance must be made, and the whole reduced to a common basis, that is to say, in the event of a fault being on a ·1 cable and a ·05 joined together, the resistance of the ·05 cable will be twice that of the ·1, and therefore in calculating the distance this must be allowed for.

STORAGE BATTERIES.

[COMMUNICATED.]

During recent years there has been a marked tendency on the part of battery manufacturers to change from hitherto generally accepted methods of working their storage cells, and make entirely new departures which in some cases appear at first sight to be diametrically opposed to the rules formerly in vogue. Probably such a radical amendment has been prompted by the fact that batteries often fall into such a bad condition that they become useless after having been at work a year or two.

This state of affairs—as has been frequently stated—*may* be due to inherent and natural defects in the battery, but it cannot always be so, and one is led to surmise that after all, the root of the whole evil lies in the treatment which has been accorded. It is impossible to draw up definite rules to be followed in the working of any article, machine, or instrument without to a certain extent being guided by results arising from "trial and error" tests, and it would seem that for many years users of batteries have followed regulations, which, to say the least of it, should have been modified a considerable time ago. Perhaps the manufacturers are to blame in this, although not wholly, as when faults are found they do not always have the full facts of the case laid before them ; in some instances not even a complaint is sent by the user, he being sufficiently satisfied to consign the whole set to the scrap-heap, and straightway purchase another battery, which, in nine cases out of ten, will act in the same way, if inattention was the original cause of the trouble.

Far more good would be done by allowing the manufacturers to send an engineer to thoroughly examine into the merits of each case, with a view of sifting out all that was wrong, so that repetitions could be avoided in the future. It is for these reasons that new recommendations have been drafted by makers which, if followed, bid fair to be the means of retrieving the bad reputations which seem to have attached to storage batteries generally.

From careful observations, during some years, of a number of sets which have been watched since the first charge was given, it has been possible to so analyse the treatment accorded to each, that all the salient details have been summarised, and when these are considered with regard to the existing state of the cells, a fair opinion can be arrived at as to what is good and wha is harmful. As can readily be understood, the process was rather tedious, entailing much work, but the writer has every reason to think that correct indications were obtained as to what could be considered beneficial treatment and otherwise, and to enable definite rules to be laid down, which should be adhered to.

It is hardly needful to say that the importance of examining each individual cell periodically was amply proved, for this would appear to be absolutely necessary, seeing that the whole battery is made up of a number of separate and distinct units, and that satisfactory working depends on each part doing its duty to the full. In spite of this being so evident, however, a very common cause of failure arises from neglect of this rule, probably either due to sheer laziness on the part of the attendant, or through his multitudinous duties keeping him constantly employed on other work. There is no doubt as to careful and systematic examination being a very tedious occupation, but, with a conscientious man who knows his battery thoroughly, it takes up little of his time, possibly not more than five or six hours per week for a set of 55 cells of average capacity. No matter how carefully individual cells may be looked after, the result of the attention is altogether wasted if regard is not had to the treatment of the battery *as a whole*, and it is here that little thought is often given, which ends, finally, in a serious diminution of the capacity and life of the cells.

Dealing, first, with the question of charging, it is apparent that all that needs to be done each time is to restore the active material in the grids to such a condition that it will be capable of giving its proper output. In other words, to reduce the lead sulphate formed whilst the previous discharge was in progress, and thus to convert both positive and negative plates to their theoretical state of PbO_2 and Pb respectively.

For any given discharge rate, the length of time current can be maintained depends solely on the quantity of lead oxide available for conversion to lead sulphate, and similarly in order to reconvert sulphate to its original state at any given current, time is the only determining factor. The product of these two values, time and current, shows in an exact measure the discharge obtainable, and the charge that should be given, and it is for this reason that each charge should be based on the ampere-hours taken out during the previous discharge, stopping the dynamo when a sufficient number of ampere-hours has been given to reduce the sulphate on the plates.

When once the relationship between the charge and discharge ampere-hours is known, it can always be safely assumed that, when a certain percentage excess has been given, the charge is completed, and yet, in spite of this easily proved fact, some makers have insisted that each charge should be continued until the electrolyte turns milky.

Nothing could lead to more disastrous results than such instructions as these, for it is clear that all that is going on subsequent to the full charge is the decomposition of water forming the electrolyte, and as the gas bubbles are liberated at the grid surface, they tend to carry with them some of the active material with which they come in contact ; it is in this way that most of the fine dust is formed, which is to be found in all storage cells, and, although minute, the loss of oxide is gradual, and in time results in a marked fall in capacity.

The dust not only decreases the output, but also settles out, assisting to form "short-circuits," which at once cause irregular working, and necessitate greater attention if the battery is to be kept in proper order.

Besides this, whilst the overcharge is being continued, the attack of the nascent oxygen on the oxide renders it very soft, and in time it only adheres very insecurely to the pockets of the grid, its nature being more like that of a semi-solid.

In a traction battery where there is any constant movement of the acid, the oxide would be washed out, and this is what frequently happens. Some makers have recognised that general instructions as to charging, such as those referred to above, have been very misleading, and whereas they were previously recommended, users are now warned against adopting them.

The required excess of ampere-hours depends not so much on the make of battery as on the type of grid, it being usually found that the highest efficiency is obtained in plates where the oxide is split up into a large number of smaller pellets, and it may here be noted that if the pellets are unduly large, portions of the oxide making contact with the grid will be charged, whilst other portions of the same pellet are only in a partially charged state. This point, however, is not important in the case of Planté formed plates, it being more applicable to the pasted pattern.

For any type of grid, the percentage excess of ampere-hours required to fully charge it is fairly constant, irrespective of the discharge rate, and it is for ordinary purposes safe to fix this at a figure, depending on the average ampere-hour efficiency, at rates which can be considered normal under the different circumstances of each case. This may be anything between 8 and 12 per cent., and the makers should be applied to for the actual figure, or it can be ascertained by making careful tests on the battery itself. This method of working has been found to answer exceedingly well; to ensure accurate results, the ampere-hours charge and discharge should be metered, so as to render it well-nigh impossible for any mistake to occur. The writer has found that in more than one instance this idea has been carried out, but instead of using ampere-hour meters, *watt-hour* meters have been used, and this has led to great error, seeing that, when the change of voltage is introduced into the question, allowance must be made for the variation, and no constant figure for the percentage of excess can then be worked to, as the watt-hour efficiency varies from 72 per cent. to 95 per cent., depending on the discharge taken with respect to the full capacity of the battery. The percentage excess, therefore, that would be correct for the full discharge, would, if followed for a half or quarter of the full output, result in considerable overcharge, and this is actually what has sometimes happened. The great drawback in advocating any system such as this lies in the fact that the attendant is apt to consider that nothing further need be done to the cells beyond giving the proper amount of charge, but this should be corrected very firmly and sharply, as each cell must be kept in good condition, and the regular examination cannot be dispensed with under any circumstances.

Should it so happen that a battery has been overcharged, the cells should not be allowed to have quite their full charge each time, as by this means a little sulphate will be introduced and kept in the active material, which will gradually harden up; there will not then be so much chance of the oxide disintegrating from the grid, as it becomes gradually firmer in structure, and although the capacity will not be improved, the fall in output will be retarded and the cells will last longer.

In the case of the negative plates, the spongy lead will decrease in volume with the overcharge, although very slightly, but it will at times shrink so much as to lose contact with the grid, and possibly have even a lower capacity than the positive plates. A little excess charge is always required above the true efficiency of the battery, in order to disperse the strong acid formed in the pores of the plates, for this must not be allowed to remain, owing to the excessive sulphating action that would be rapidly set up.

It is quite natural for this strong acid to leave the plate as soon as it is formed, but the passage of the gas through the electrolyte mixes the stronger acid with the weak and gives a uniform density at all levels. Being denser, the strong acid will want to sink to the bottom, and the gas tending to carry it upwards ensures thorough mixing.

It does not follow that ampere-hour meters are absolutely necessary, but, by using them, there is a far better indication of the work the cells are doing than can be ascertained from a calculation, which is, at best, only approximate. They are objected to sometimes on the score of price, and sometimes for inaccuracy. Although a number of instruments on the market cannot be altogether relied upon for accurate work, it is quite possible to obtain meters which can be set to read within ½ per cent., and there is no need to insist on greater exactness, the chief point being to know for certain the difference in error, if any, between the charge and discharge instruments, and to make the necessary corrections.

It is not every meter manufacturer that will guarantee greater accuracy than the 2½ per cent. allowed by the Board of Trade, but it can easily be seen that 2½ per cent. error causing the meter to read fast when discharging, and 2½ per cent. slow when charging, may lead to 5 per cent. overcharge, and this must be avoided.

Whilst on the subject of meters, it might be mentioned that two integrating instruments are preferable to one of the reversible type, as the latter can still be made to read aright, although the maximum discharge in ampere-hours has been exceeded, an equivalent number of ampere-hours overcharge being given to counterbalance.

Instructions were issued at one time by a firm of battery makers to charge on each occasion until the specific gravity rose to normal value in each cell; after some months it was found that very considerable charge had to be given in order to attain the right density, and soon afterwards it was impossible to restore the gravity to its original figure, no matter how much charge was given. What had happened was, that the electrolyte, although of uniform density when first placed in the cell, had gradually settled out, the stronger and therefore heavier acid at the bottom and the lighter on top. This is frequently met with in practice, and it is not very easy to suggest a remedy. The hydrometer being a small one, and immersed in the top layers of the electrolyte, indicated a low density, and so the charge was prolonged each time, although no good was done except to agitate the electrolyte by the gas bubbles. Some of the acid also evaporated and was thrown off by the spraying action, and after water had been added—according to instructions—matters became worse, until the method of charging was put on a new basis. The principle of fully charging had altogether been lost sight of, and it should be remembered that although under normal conditions the acid regains its previous density at the end of a charge, it will naturally fall a little during the course of time, but it is of minor importance if kept within a reasonable limit of 30° or 40°. It is a well-known fact amongst battery users that the density varies with the temperature of the atmosphere, the proportion being 1° fall for every 2° F. rise, and *vice versâ*, so that densities are always lower in the summer, and a little higher in the winter months. The temperature, therefore, should always be taken into account when dealing with specific gravities, although what is true for one cell in any battery, is also true in this respect for the remainder. The proper time to make specific gravity comparisons is at the end of charge, although the voltage per cell at the end of discharge is a truer indication of the health of the plates.

Frequently the potential difference at the terminals of an internally short-circuited cell is the same as that of the others during charge, but the defect is at once intensified on the discharge volts, the indication being much more accurate. There is a rule in several makers' instructions that records be kept of each charge and discharge (voltage, current, &c., at different periods), and this is made a very prominent feature in all maintenance contracts, although it is questionable in many instances whether any material good results. The case would be met equally well if the ampere-hours charge and discharge were booked each day with the final closed-circuit voltage at the end of discharge, and it is also sufficient if hydrometer readings are booked once a month, but taken once a week. This gives all the information that a careful man requires, but frequently just as much good would be done by a dynamo attendant booking down the output of his dynamo at different times, which would at once be characterised as absurd, if it were intended that the figures so obtained should assist in the upkeep.

There are, of course, a number of special cases where detailed information is very necessary, but, in a large measure, the manufacturers' policy is one of retaliation, for whilst customers will insist on being quoted low maintenance rates, the makers are bound to cover themselves in this way by imposing certain rules and restrictions which,

at some time or other, are sure to be broken when the opportunity is at once seized to cancel the agreement.

In some cases it would seem that the rules laid down are a series of pitfalls and traps to catch the unwary user, who finds he has quite unintentionally broken the contract, and is then left to deal with the cells as best he can, for the makers repudiate any further responsibility from that time forward. This, as stated above, arises through the folly of selecting a battery mainly because a low first cost and maintenance is quoted; and as the average cell has a life not exceeding 8 or 10 years, the absurdity is at once recognised of so low a figure as 3, 4, and even 5 per cent.

On the question of using distilled water, and the elimination of impurities from the acid and plates, the makers' advice remains unchanged, as it is obviously very important to prevent any local action being set up which would be detrimental to the useful capacity of the battery.

There are, undoubtedly, modifications to be made to suit the requirements of some special cases, but in a general way these few notes, based on actual experience, indicate how a battery should be worked.

TECHNICAL EDUCATION: THE DUTY OF THE STATE.

By A UNIVERSITY LECTURER.

A few days ago an influential deputation waited upon the Prime Minister and the Chancellor of the Exchequer, in order to impress upon them the need of further State aid for the Universities. It was probably the outcome of the notable address delivered by Sir Norman Lockyer before the British Association, and which was entitled "The Influence of Brain Power upon History." This year it will be Mr. Balfour's turn to address the British Association as President. He may choose as his subject "The Influence of State Aid upon Higher Education." He will not need to turn his attention to any country more distant than Germany. The influence of such State aid upon that country is not disputed as are other influences; such as, for example, that of Protection. In fact, some politicians, of such repute in educational circles as Mr. Haldane, tell us that *in spite of Protection*, State aid for science in Germany has brought that country into its present position.

Engineers will take a special interest in the deputation if only from the fact that the oldest Engineering Institution, that of the Civil Engineers, was represented by its President, Sir William White. It is true that most of us would have been more pleased if the Institutions of Electrical and Mechanical Engineers had also been represented. And Sir William had a doleful tale to tell about England's neglect of science. "If the position of this country," he said, "is to be maintained, it is absolutely necessary that our system of technical education should be placed on the best possible basis." And again, we may be sure after most mature consideration of the facts of the case, he plainly told the Prime Minister that "the scanty provision now existing must be enlarged by State aid, and placed more on an equality with that made in France, Germany and the United States." It was rather surprising, and none too reassuring, to be informed that at the Technical High School at Charlottenburg there were, two years ago, some 380 students in marine engineering and naval architecture. It is pretty safe to say that the number of such students in that one school in Germany widely exceeded the total number systematically attending a college course in such subjects in England. At the Admiralty training colleges of Keyham and Greenwich the number is less than 250; perhaps there are a few such students at Durham and Liverpool, although one hears little about them.

Nor was it comforting to note that the result of Mr. Alfred Mosely's researches in the field of education had led him to send his two sons to Yale College, in America. No one can doubt Mr. Mosely's patriotism, but no one who knows the tremendous difficulties under which our English university colleges are labouring for want of funds could resist a feeling of indignation that such a course should have been necessary. We may be assured that Mr. Mosely obtained the views of the technical members of his famous Educational Commission. Are we to assume that this jury found a verdict of "Guilty" on the score of inefficiency of English university colleges when questioned on this subject? And we, who see the wheels of our higher educational machinery clogging for the want of that all-powerful lubricant, money, would have reason to feel ashamed of our efforts, to feel that we were indeed ploughing the sands, if we ourselves were altogether to blame. It is complained that some of us are too academic in our methods. None of us are perfect in our work, but we labour in the face of difficulties—the poverty of our institutions—which no self-respecting engineering establishment knows anything about. "Difficulties are made to be overcome" I fancy I hear the cynical reader say. Yes, but it is hard to have to wearily describe a piece of apparatus, costing a few pounds, because there is no money with which to purchase it. Harder still to keep the student interested in the description. Engineering cannot be taught by means of chalk and blackboard; helpful and necessary introductory subjects such as mathematics, and, perhaps, some portions of physics and chemistry, can be so taught, but let me have the apparatus and I will rivet the attention and concentrate the wandering thoughts of my student upon his work. Not even the helpful lantern slide will show him the various advantages and disadvantages of, say, two different types of indicators. Not all of my blackboard diagrams will teach him so eloquently the defects of faulty valve setting or wire-drawing as that diagram which I make him take from the college engine, when I have arranged that it shall not work under normal conditions. "Poverty is no crime"—but it is mighty inconvenient. The country pays some 13 million pounds per annum for primary education, and bestows, in its gratitude to the work of bygone scientists who have made possible engineering as it is interpreted to-day, a few thousands upon our university colleges!

It is interesting to note the efforts that have been successfully made in the Midlands to arouse a feeling of local patriotism for the University of Birmingham. Personality has done a great deal; both the Chancellor and Principal are men honoured and respected, and men of very great local influence. But energy and enthusiasm have also helped. Recently the writer accepted an invitation to see a Degree Congregation at Birmingham, and it would certainly astonish most people to see how much a portion of Birmingham is the University. The citizens are proud of it, and justly so. They attend in their thousands to see the degrees bestowed. The Lord Mayor attends in State. The local newspapers devote a great deal of space to university items of interest. In five years they have subscribed £450,000 *locally* for the new university. They have levied a ½d. rate over the city, which brings in £7,000 a-year. The neighbouring counties support the university out of their coffers. A local landowner gave a site of 30 acres for the new technical buildings. Local firms have given machinery. And what has London done? How will the metropolis of the Empire compare with the Midland metropolis? Think of a ½d. rate over the London area! Think of a site of 30 acres for a London Charlottenburg! And if Birmingham, with its half-a-million inhabitants, has subscribed almost half-a-million of money for its University, what might not London do with its millions of inhabitants? But, alas! it is among the London colleges that starvation for want of funds is most apparent; cramped for room, badly wanting money, the London colleges still struggle on. Let them have more money and the increased efficiency will be quickly noticeable. For, despite their defects, some of the best engineers have been trained in the London colleges. They probably have the best, and the worst material to work upon; but the path by which the student is led to a knowledge of his profession is long and tedious. Only money can shorten it.

In replying to the deputation, Mr. Balfour said that the fault of the present state of higher education lay, to some extent, with the manufacturers. They seem to think that the captains of industry should be trained only in the works. This may have been the case a few years ago, but now-a-day, all of the front rank firms give preference to university-trained men. We turn out some failures—they would have

been called "wasters" if their apprenticeship had been in a brass foundry—and whether we train our students in workshop, laboratory, and lecture room, or whether we work upon the "sandwich system," no one will deny that the engineer is a more intelligent and useful individual when he works out his problem with a full knowledge of his subject, than when he "trusts in Molesworth—and chances the decimal point."

Then, again, both Mr. Balfour and the Chancellor of the Exchequer thought that State aid would prevent the endowment of our Universities by rich manufacturers. Did they think about this when they made it possible for the State to support the *whole* of primary education? And it must be confessed that the support given by the rich manufacturer is such that it would be readily exchanged for something more certain.

The younger provincial universities are going along on the right lines, and are doing their utmost to make themselves popular. But even Birmingham wants a million pounds, and cannot raise one-half that amount. Throughout the country there is the same cry. I am not aware that it is possible to obtain instruction in engineering at any University College south of the Thames—unless Bristol be reckoned south of that river. There must be few University Colleges where there are separate professors of civil, mechanical, and electrical engineering. There are no University Colleges where the curriculum could not be made of far greater benefit to the student if there were more funds. The generosity and the patriotism of the citizen and the manufacturer has been appealed to often and often. Sometimes there has been a response. But this source of income is too uncertain. It is the duty of the State to institute full inquiries. When one remembers the hundreds of thousands of pounds which have been wasted in technical schools for evening classes—for the writer knows by experience that few evening engineering students are sufficiently fresh to benefit by evening tuition—and then thinks of the poor equipment of our University Colleges, it seems that a great mistake has been made. Let the State adequately support the latter and make full provision by means of scholarships for the occasional smart youth who at present benefits by the technical school. It is needless to quote the huge sums of money spent by the State upon the Navy, Army, Civil Service, and primary education. We cannot escape the feeling that for higher education the State has neglected its duty. And so we must cast envious eyes upon Germany and America—and hope for better things from the State in England.—C.A.S.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

14,933. "An improved mode of protecting life from the 'live rail' danger on electric railways." H. Curwen. July 4th.

14,940. "An electric time switch." A. J. Parsons and H. Mandfield. July 4th.

14,986. "Improvements in actuating magneto-electric igniters of explosion motors for cycles and other vehicles." L. Ziedler. July 4th.

15,034. "Improvements in electric arc lamps." Crompton & Co., Ltd., and A. J. Hodgson. July 5th.

15,035. "Improvements in instruments for the measurement of electrical resistances." K. Edgcumbe and E. I. Everett. July 5th.

15,041. "Improvements in means for signalling to and communicating with telephone exchanges." G. Ellis. July 5th.

15,043. "Improvements in electric transmitters." H. H. Lake. (Submarine Signal Co., United States.) July 5th. (Complete.)

15,046. "A system for recording the number of telephone messages." H. S. Williams. July 5th.

15,054. "Improvements in and relating to apparatus employed in connection with electric telephones." W. Walker. July 5th.

15,067. "Improvements in electric arc lamps." E. A. Carolan. (The General Electric Co., United States.) July 5th.

15,068. "Improvements in electric arc lamps." E. A. Carolan. (The General Electric Co., United States.) July 5th.

15,070. "Improvements in and relating to the control of electric motors." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 5th.

15,117. "Improvements in electric cut-outs." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 6th.

15,118. "Improvements in dynamo-electric machines." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 6th.

15,131. "Improvements in electric railways or tramways." W. F. Gibbs. July 6th.

15,199. "A new or improved device or apparatus for fixing electric lamps in the sockets of overhead electroliers, brackets and the like, or for detaching them therefrom." W. V. Biggs. July 7th.

15,203. "Electric burglar and fire alarm." C. A. Ali. July 7th.

15,226. "Improvements in the method of selecting electrical impulses." D. W. Troy. (Date applied for under Patents Act, 1901, July 11th, 1903, being date of application in United States.) July 7th. (Complete.)

15,230. "Improvements connected with electric arc lamps." L. Calvert and W. A. Snape. July 7th.

15,253. "Improvements in dynamo electric machines and motors." W. R. V. Marshall. July 8th.

15,255. "Improvements in omnibuses, horse cars, electric cars and the like." H. Illingworth. July 8th.

15,258. "Improvements in electro-magnetic switch devices for telephone stations." P. Arnheim. (Date applied for under Patents Act, 1901, July 20th, 1903, being date of application in Germany.) July 8th. (Complete.)

15,261. "Improvements in dynamo-electric machines." W. A. Ker. July 8th.

15,267. "Improvements in electric light fittings." J. G. Irving. July 8th.

15,283. "Improvements relating to the charging of accumulators for self-propelled vehicles." R. S. McLaren. July 8th.

15,289. "Improvements in the handles of spanners, pliers, and other tools used in electrical work." H. D. Bailey and P. O. Bonniwell. July 8th.

15,289. "Improvements in relays for direct current automatic circuit-breakers." C. C Garrard and Ferranti, Ltd. July 8th.

15,290. "Improvements in electrical measuring instruments." C. C. Garrard and Ferranti, Ltd. July 8th.

15,294. "An improved process of electro depositing antimony." A. G. Betts. July 8th.

15,296. "Improvements in electric elevators." R. E. Phillips. (E. H. Vogel, United States.) July 8th. (Complete.)

15,298. "An improved process of treating the metal mixtures produced as a bye-product in electrolytic metal refining operations." A. G. Betts. July 8th.

15,300. "Improvements in electric transformers." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 8th.

15,301. "Improvements in electric railways." The British Thomson-Houston Co., Ltd. (The General Electric Co, United States.) July 8th.

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15,303. "Improvements in enclosed fuses." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) July 8th.

15,304. "Improvements in and relating to electric controllers." The British Thomson-Houston Co., Ltd. (The General Electric Co, United States.) July 8th.

15,312. "Improvements in or connected with means for the manufacture of brasses or bushes for the bearings of shafts, axles, or the like, more especially applicable to electro-motors." W. H. Tomson and W. G. Hanna. July 8th.

15,332. "Improvements in sliding apparatus, for raising or lowering chandeliers, electroliers, gas pendants, and the like." J. W. Lea and J. H. Perkins. July 9th.

15,343. "Improvements connected with overhead electric railways." A. Anderson and J. F. Dunne. July 9th.

15,344. "An automatic safety device particularly applicable in connection with falling overhead trolley or other wires passing over or running parallel with same." H. H. Berry and F. Risch. July 9th.

15,360. "Electrolytic circuit-breaker." A. Kölling. July 9th. (Complete.)

15,367. "Improvements in couplings for electrical wires." J. G. Thomas and D. E. Lewis. July 9th. (Complete.)

15,382. "Improved sub-station connecting arrangement for telephone systems." I. B. Birnbaum and H. G. White. July 9th.

15,386. "Mechanical and electrical elevator for goods, especially goods contained in sacks." J. B. Rubando, A. Estier, H. Estier, J. Mallet, and A. Mouren. July 9th.

15,391. "Improvements relating to surface-contact electric railway systems." W. M. Brown. July 9th. (Complete.)

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Magneto-Electric Igniting Apparatus for Internal Combustion Engines. W. Roos. 27,576. December 16th.

Casings for Electric Wires. H. J. Walker. 27,585. December 16th.

Safety Device for the Switches of Electrically Driven Suspended Railways. T. A. Hearson. (A. B. Leichert & Co., Germany). 27,734. December 17th.

Safety Devices for Electric Railway Systems. G. Gibbs. 27,924. December 19th.

Electric Lamp particularly for Miners' Use. La Société des Accumulateurs, Chelin. 27,825. December 19th.

Telephone Systems. P. Hardegen. 27,900. December 19th.

Electrical Indicating Apparatus for Communicating and Recording Instructions. H. Blender. 18,755. August 31st.

Printing Telegraph Apparatus. H. Caswitz. 19,553. September 10th.

Electrically-operated and Controlled Railway Signals. R. L. Peters and H. H. Ellingson. 19,540. September 10th.

Improvements in Electricity Meters. P. Rieunier. 20,155. September 18th. (Date applied for under Patents Act 1901, October 2nd, 1902, being date of application in France.)

Composition for Use in the Cells of Electrical Batteries. W. H. Wheatley. (The Atwood Electric Co., United States.) 28,057. December 21st.

Improvements in Electrically-operated Switches or Points for Electric Railways. W. H. Hilyer. 28,147. December 22nd.

Coin-Feed Apparatus for Electricity Supply Meters. A. Sabat. 28,232. December 23rd.

Receivers for Electro-Magnetic Waves. R. A. Fessenden. 28,291. December 23rd. (Date applied for under Patents Act, 1901, April 9th, 1903, being date of application in United States.)

Wave Telegraphy. R. A. Fessenden. 28,290. December 23rd.

Trolley Arms for Electric Traction. C. B. Robertson. 28,355. December 24th.